TOTAL QUALITY MANAGEMENT AND CUSTOMER SATISFACTION IN HOME BUILDING

By

ZELJKO MARKO TORBICA

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1997

The dedication of this dissertation is devoted to my daughter Talia and to the memory of my mother Nadezda.

ACKNOWLEDGMENTS

It is with my sincere gratitude that I thank all the individuals who contributed time and effort toward the success of this dissertation.

I express my gratitude to Dr.Robert Cox, Dr.Diane Schaub, Dr.Kwaku Tenah, and Dr.Leon Wetherington, for their unwavering support and guidance throughout my course of study. They provided both instruction and challenge which made this study a valuable learning experience.

The most sincere appreciation is reserved for my chair and mentor, Dr.Robert Stroh, who provided key leadership and guidance throughout the development of this document. This research could not have been undertaken without his enormous effort. I wish to thank him for recognizing my potential and motivating me to achieve my best.

I would also like to thank the many University of Florida professors for having me as a student. Their contributions to my education are immeasurable.

Special thanks are credited to the Shimberg Center for Affordable Housing and Energoprojekt, Belgrade, for making my studies at the University of Florida possible.

Finally, I owe my greatest appreciation to my family. Their love, understanding, and encouragement made my life and study meaningful.

TABLE OF CONTENTS

page

ACKNOWLEDGMENTS iii

LIST OF TABLES viii

LIST OF FIGURES ix

ABSTRACT xi

1 INTRODUCTION 1

Background 1
Statement of the Problem 2
Controversy Surrounding Total Quality Management (TQM) 3
Customer Satisfaction 3
Impact of Total Quality Management (TQM) on Customer Satisfaction 4
Research Description and Scope 4
Purpose and Objectives 5
Overview 5
Chapter Summary 6

2 THE QUALITY MOVEMENT 8

Introduction 8
Total Quality Management (TQM) 9
Quality Terminology 10
Total Quality Management Definition 10
Quality Background 13
Quality in Construction 15
Conformance to Requirements Definition of Quality 15
Customer Satisfaction Definition of Quality 18
Controversy Surrounding Total Quality Management Results 19
Positive Correlates of Total Quality Management to Business Performance 19
Negative Correlates of Total Quality Management to Business Performance 21
Problem Statement 22

Chapter Summary 23

3 CUSTOMER SATISFACTION 24

Background 24
Customer Satisfaction Definition 25
Quality and Customer Satisfaction Relationship 27
Key Benefits of High Quality and High Customer Satisfaction 28
Customer Satisfaction as a Performance Criteria 31
Problem Statement 33
Chapter Summary 34

4 CUSTOMER SATISFACTION MEASUREMENT 36

Background 36
Terminology 37
Customer Satisfaction Model 39
HOMBSAT--An Instrument for Measuring Home-Buyer Satisfaction 41
Generating Items For HOMBSAT 43
Product Component of HOMBSAT 43
Service Component of HOMBSAT 45
Number of Items 47
Rating Scales 49
Chapter Summary 50

5 RESEARCH METHODOLOGY 51

Introduction 51
Theory Foundation 52
Research Design 54
Total Quality Management Survey 54
Total Quality Management Questionnaire 56
Population and Sample Selection 57
Administration 58
Chapter Summary 60

6 CUSTOMER SATISFACTION SURVEY 61

Introduction 61
HOMBSAT - An Instrument For Measuring Home-Buyer Satisfaction 63
Questionnaire for Measuring Home-Buyer Satisfaction 63
Home-Buyer Satisfaction Survey Administration 64
Timing of Measurement 64
Questionnaire Administration 66
Testing of HOMBSAT Instrument 67
Validity 69

Content Validity 69
Construct Validity 70
Criterion Validity 74
Reliability 75
Factor Scores 76
Chapter Summary 78

7 DATA ANALYSIS 79

Introduction 79
Summary of the Data 80
Total Quality Management Data 80
Total Quality Management Scores 81
Home-Buyer Satisfaction Data 81
Home-Buyer Satisfaction Scores 82
Regression Analysis 83
Analysis of Home-Buyer Satisfaction Data 85
Multiple Regression Model for Overall Satisfaction 85
Model Evaluation 87
Relative Importance of the Three Dimensions of HOMBSAT 89
Industry Performance 91
Implications 92
Relationship Between Total Quality Management and Home-Buyer Satisfaction 93
Analysis 95
Dependent Variable: Total Company Home-Buyer Satisfaction (SATIS) 95
Dependent Variable: DESIGN 99
Dependent Variable: HOUSE 103
Dependent Variable: SERVICE 104
Current Level of Industry Practice of TQM 108
Implications 112
Chapter Summary 113

8 CONCLUSIONS AND RECOMMENDATIONS 114

Assessment of Home-Buyer Satisfaction 114
Impact of Total Quality Management on Home-Buyer Satisfaction 115
Study Contributions 116
Development of the Instrument for Measuring Home-Buyer Satisfaction--HOMBSAT 116
Model to Predict the Impact of Total Quality Management on Home-Buyer Satisfaction 117
Recommendations for Future Research 118
Conclusion 119

APPENDICES

A COMPARISON OF ITEMS PROPOSED BY SARAPH, BENSON, AND SCHROEDER (1989) WITH ITEMS USED IN PRESENT STUDY 121

B HOMEBUYER SATISFACTION SURVEY PACKAGE 129
Cover Letter Used In Home-Buyer Satisfaction Survey 130
Follow-up Letters for Home-Buyer Satisfaction Survey 131
Questionnaire For The Study Of New-Home Buyer Satisfaction 132

C COVER LETTER USED IN TOTAL QUALITY MANAGEMENT SURVEY 142

D HOMBSAT INSTRUMENT 145

E TOTAL QUALITY MANAGEMENT AND HOME-BUYER SATISFACTION SCORES 150

LIST OF REFERENCES 152

BIOGRAPHICAL SKETCH 160

LIST OF TABLES

Table page

4-1. Eight Dimensions of Quality 44

4-2. Three Elements of Building Performance 45

4-3. Determinants of Service Quality 48

6-1. Home-Buyer Satisfaction Survey Summary 68

6-2. Structure Matrix for HOMBSAT 73

6-3. Structure Matrix for the Final HOMBSAT Instrument (59 items) 74

6-5. Factor Correlation Matrix 74

6-6. Structure Matrixes for DESIGN, HOUSE, and SERVICE 77

6-5. Correlation Coefficients Between Three Factor Scores, Their Mean, and Overall Satisfaction 77

LIST OF FIGURES

Figure page

2-1. Two Frameworks for Defining Quality 13

3-1. Mission Statements Reflecting Commitment to Customer Satisfaction are Becoming the Industry Standards 26

3-2. Three Possible Relationships Between Quality and Customer Satisfaction 28

4-1. Customer (Home-Buyer) Satisfaction Model 40

4-2. A Typical Scale From Questionnaire Used to Measure Home-Buyer Satisfaction 49

5-1. Flow-Chart of Research Methodology 52

5-2. A Typical Questionnaire Item From TQM Questionnaire 57

6-1. A Typical Item From HOMBSAT 62

6-2. Home-Buyer Satisfaction Survey Summary 68

7-1. Histogram for OVERALL 86

7-2. The Scatter Plots of DESIGN, HOUSE, and SERVICE with OVERALL 87

7-3. Scatterplot for OVERALL 88

7-4. Comparison of Importance and Performance for Design, House, and Service 92

7-5. What is the Relationship Between TQM and Home-Buyer Satisfaction? 93

7-6. Histogram for SATIS 96

7-7. Scatterplot of standardized residuals for SATIS 97

7-8. Scatterplot for SATIS 99

7-9. Histogram for DESIGN 100

7-10. Scatterplot of standardized residuals for DESIGN 100

7-11. Scatterplot for DESIGN 102

7-12. Histogram for HOUSE 103

7-13. Scatterplot of Standardized Residuals for HOUSE 104

7-14. Histogram for SERVICE 105

7-15. Scatterplot of Standardized Residuals for SERVICE 106

7-16. Scatterplot for SERVICE 108

7-17. Duncan Comparison of Critical Factors Mean Scores 109

7-18. Comparison of Importance and Levels of Performance for Critical Factors of TQM for SATIS 110

7-19. Comparison of Importance and Levels of Performance for Critical Factors of TQM for DESIGN 111

7-20. Comparison of Importance and Levels of Performance for Critical Factors of TQM for HOUSE 111

7-21. Comparison of Importance and Levels of Performance for Critical Factors of TQM for SERVICE 112

7-22. Matrix of Associations Between Measures of Company's TQM Practice and Measures of Home-Buyer Satisfaction 113

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

TOTAL QUALITY MANAGEMENT AND CUSTOMER SATISFACTION IN HOME BUILDING

By

Zeljko Marko Torbica

December 1997

Chairman: Robert C. Stroh
Major Department: College of Architecture

With most markets declining in recent years, the construction industry has become substantially more competitive and higher-risk. Providing superior quality and keeping customers satisfied are rapidly becoming the ways companies differentiate themselves from competitors. Many companies are, however, frustrated in their efforts to improve quality and customer satisfaction through the implementation of Total Quality Management (TQM). They question the link between TQM effort and economic returns and competitiveness.

The two primary objectives of this study were (1) to establish a reliable and valid instrument for measuring home-buyer satisfaction and (2) to increase understanding of how Total Quality Management affects home-buyer satisfaction. Two separate surveys were conducted. First, a survey about TQM practice in home building was conducted using data collected from 16 medium to large residential companies located in Florida.

Second, data were collected from the home buyers of the participating companies regarding their levels of satisfaction.

Based on thorough examination of the literature, a model was proposed describing home-buyer satisfaction as a three-dimensional composite of satisfaction with design, house, and service. An instrument for measuring home-buyer satisfaction, called HOMBSAT, was developed and tested. The instrument was shown to be reliable and valid.

This study resulted in new insights regarding TQM and home-buyer satisfaction. All three dimensions of home-buyer satisfaction were found to be significant predictors of overall home-buyer satisfaction. Service emerged as the most important component in shaping the overall home-buyer satisfaction. However, service was the area in which home builders demonstrated the poorest performance. The implication is that service is the area with greatest potential for competitive advantage. It can have a far-reaching positive influence on the home-buyer satisfaction.

For the first time an empirical study has confirmed that implementation of TQM is positively associated with home-buyer satisfaction. This result is especially interesting after the recent critique of effectiveness of TQM initiatives. It was shown that 31% of the variance in company home-buyer satisfaction (SATIS) is explained by the total company TQM score (TOTALTQM). Supplier Quality Management has emerged as the most important factor in shaping all three aspects of home-buyer satisfaction, and yet, it is the area which home builders do not practice extensively.

CHAPTER 1
INTRODUCTION

Background

Construction is a major factor in the economy of the United States. During the first six months of 1997 $274.1 billion of new construction was put in place (U.S. Department of Commerce 1997). Traditionally, single-family segment of construction has been one of the busiest in the industry. In 1996, single-family production reached 1.157 million of housing starts with new home sales of 749,000 units (NAHB 1997).

Single-family construction will continue to play a major role in the economy of the nation. Several factors are in support of such an optimistic prediction. The United States needs to construct 1.3 to 1.5 million housing units annually just to meet the demand population growth creates (Builder 1996). Ownership of a single-family detached house is still the most predominant type of housing preferred by the majority of prospective home buyers (see for example Cooper 1974; Winter and Morris 1977; Kaynak 1985). In 1995 Clinton administration unveiled the National Homeownership Strategy with a goal of increasing the nation's homeownership rate to 67.5 percent by the turn of the century (Builder 1996).

Home building is, on the other hand, a very competitive and diverse industry plagued with a high bankruptcy rate among home builders (Weicher 1981). It is a diverse industry subject to rapid competitive change. Today's new-home buyers are continually

pressing for higher levels of quality. Their expectations have climbed dramatically--they want both high quality and low price. All that compels home builders to seek strategies to improve their performance.

Statement of the Problem

With most markets declining in recent years, the construction industry has become substantially more competitive and higher-risk. Observers close to the industry have expressed great concern over the problems facing the industry. The industry has been criticized for common cost overruns, expensive delays, high accident rates, ever-increasing litigation costs, and declining international competitiveness. One of the most widely cited factors for such an alarming trend is quality or rather, the lack of it (Davis and Ledbetter 1988). Indeed, there is a widely perceived belief that quality of construction has declined significantly which eventually resulted in widespread client dissatisfaction with engineering and construction services (Business Roundtable 1983).

There is a consensus among professionals and researchers that the solution to the problem lies in formal quality management at all levels of design, procurement and construction. As Tucker puts it: "The future advancement and accomplishments of our industry will depend upon our acceptance of the quest for quality much more than reaching any specific milestones" (Tucker 1990, p.152). Providing superior quality is rapidly becoming the way for companies to differentiate themselves from competitors and win more projects. To meet this quality challenge, many companies are adopting new management practices that focus on the continuous improvement of product and service quality. All these practices have come to be known as Total Quality Management (TQM).

Controversy Surrounding Total Quality Management (TQM)

The media have been sending mixed messages about the actual impact of Total Quality Management initiatives. The literature linking quality to outcomes such as market share, cost, and profits have yielded conflicting results. Some firms are delighted with the results of their TQM initiatives, reporting significant improvements in customer satisfaction, employee satisfaction, as well as, subcontractor and supplier relationships. Other firms, however, have expressed criticism concerning the effectiveness of their quality programs. For many of them TQM already has negative connotations. Such conflicting signals imply that general understanding about quality is becoming increasingly complex and puzzling. Has TQM as a business philosophy been successful or unsuccessful? Is the TQM philosophy flawed or do the flaws lie in the implementation of TQM?

Customer Satisfaction

The central point of the Total Quality Management movement is the concept of customer satisfaction. Satisfied customers are said to be the backbone of home building. Although the construction industry has recognized quality and client satisfaction as decisive business factors, it is still unknown how well the industry is meeting client expectations. This study attempts to find answers to the following questions: How can we measure home-buyer satisfaction? What variables are important to influencing home-buyer satisfaction? How do they relate to each other? How each variable impacts home-buyer satisfaction and what is its relative weight? How can a company identify and control these variables so that it results in improved home-buyer satisfaction?

Impact of Total Quality Management (TQM) on Customer Satisfaction

Many companies are frustrated in their efforts to improve quality and customer satisfaction through the implementation of TQM and begin to question the link between TQM effort and economic returns and competitiveness. This study investigates the nature and strength of the link between TQM and home-buyer satisfaction. We asked the following questions: How does Total Quality Management affect home-buyer satisfaction? Can home-buyer satisfaction be predicted by TQM practice? What aspects of TQM are the most closely related to home-buyer satisfaction? What areas of improvement will have the greatest impact on home-buyer satisfaction?

Research Description and Scope

This is an exploratory study focused on two important aspects of home building: quality performance of home builders and home-buyer satisfaction. We want to examine empirically a company's quality performance as measured by the degree of home buyers' satisfaction. The evaluation of performance in construction generally focuses on a limited number of performance elements that can be expressed by the following statement: "get the project completed and accepted within the schedule and the budget" (Sanvido 1988; Maloney 1990). There are several additional success criteria that are important but receive little attention. Customer satisfaction is one of them. It is possible to have dissatisfied, or at least not satisfied, customers even though explicit time, cost, and performance criteria have been met. The basic premise of this study is that only by measuring the level of home buyers' satisfaction can we achieve a true measurement of a company's quality performance.

Purpose and Objectives

The purpose of this study is to improve the quality performance of home building industry, which will ultimately result in improved home buyers' satisfaction. More specifically, this study has two main objectives. The first objective is to establish reliable and valid measures for the assessment of home-buyer satisfaction. It will be accomplished by defining and examining the dimensionality of the concept of customer satisfaction with single-family housing purchased for owner occupancy. The second objective is to increase understanding of how Total Quality Management affects home-buyer satisfaction. It will be accomplished by exploring the significance of the various aspects of TQM on home-buyer satisfaction.

Overview

This study was conducted in the home-building segment of the construction industry, Federal SIC code 1521. Data were collected from 16 medium to large residential companies located in Florida. We utilized survey as a research design and a questionnaire as a data collection method. Two separate surveys were conducted. First, a survey about Total Quality Management practice in home building was conducted ("TQM Survey"). To measure the degree of implementation of TQM an instrument developed by Saraph, Benson, and Schroeder (1989) was used. Based on a thorough review and synthesis of the quality literature, Saraph and associates proposed a comprehensive set of eight critical factors of managerial planning and action that must be practiced to achieve effective quality management in an organization. The instrument contains operational measures for each of the factors, totaling 78 items. The authors suggested that these

measures could be used independently or in combination to produce a profile of company quality management.

As a part of the first survey, companies were asked to provide a complete listing of their homebuyers for the specified period August 1995 through October 1995. Obtaining names and addresses of companies' customers was the prerequisite for the administration of the second survey--a home-buyer satisfaction survey. In order to assess home-buyer satisfaction we had to develop an instrument to enable structured observation and measurement of satisfaction. Based on an exhaustive and thorough examination of the literature we developed a model which views home-buyer satisfaction as a composite, three-dimensional, satisfaction with design, house, and service. The instrument was tested and shown to be reliable and valid. Once the surveys were completed, we proceeded with processing and analyzing the data. Regression method and ANOVA analysis were used to find the answers to the stated research questions. The study concludes by discussion of the analysis findings and implications, which will help guide the home building industry in its quest to improve the quality of its houses and to provide better service to customers.

Chapter Summary

This introductory chapter outlines the research problem addressed by this study. Chapters 2 and 3 cover theoretical background and definitions of two increasingly important business concepts, Total Quality Management and customer satisfaction. Chapter 4 presents a framework for modeling home-buyer satisfaction. The methodology used in this study is discussed in Chapter 5. Chapter 6 outlines the process of development of an instrument for measuring home-buyer satisfaction. Reliability and

validity assessments of the instrument are presented in this chapter, as well. Analysis of data is conducted in Chapter 7. Chapter 8 outlines the research findings, contributions, and recommendations for the future work.

CHAPTER 2
THE QUALITY MOVEMENT

Introduction

In the past, concern for quality in the construction industry has been a relatively insignificant consideration. There is a widely perceived belief that quality of construction has declined significantly which eventually resulted in widespread client dissatisfaction (Business Roundtable 1983). With most markets declining in recent years, the construction industry has become substantially more competitive and higher-risk. Providing superior quality is rapidly becoming the way for designers and contractors to differentiate themselves from competitors and win more projects. To meet this quality challenge, many companies are adopting new management practices that focus on the continuous improvement of product and service quality. As a result, concepts and ideas of Total Quality Management (TQM) have been extensively discussed and analyzed during the past 15 years.

In this chapter, we present some background on TQM movement. Secondly, we attempt to clarify and explicate concept of quality. The chapter will conclude with conflicting messages concerning the effectiveness of TQM programs and by addressing the need for more research to systematically assess and document the results of TQM initiatives.

Total Quality Management (TQM)

Quality began to emerge as a key management focus in the US in early 1980s in an attempt to improve the position of American industries. No matter what media we see or listen to, we will come across an article or advertisement describing a quality product, service or company. Quality initiatives in manufacturing have gotten the attention of business owners, regardless of the industry. Construction industry is by no means an exception. The need for such attention has long been presented based on all available evidence (Tucker 1990). Many studies have tended to present a rather unfavorable picture of the industry performance: there is a general decline in construction quality, productivity is down, delays are common and expensive, litigation is up, and foreign firms are taking a greater share of the market (see for example Davis et al. 1989; Modern Management Systems 1983; Tucker 1990; Wiggins 1988; Yates 1992). All that compels designers and contractors to seek strategies to improve their quality performance. They have come to realize that in increasingly competitive market place a key to survival is improving quality and keeping customer satisfied. The concepts and ideas of Total Quality Management (TQM) have been extensively discussed and analyzed in an attempt to improve the position of the industry. Construction companies have adapted the methods and concepts of TQM that are being used in US manufacturing and applied them to construction operations with minor modifications (Burati et al. 1991). We have begun to see a shift from an inspection-oriented approach toward a defect-prevention and company-focused quality strategy.

Quality Terminology

Quality practices presently employed in the US use different names: Quality Management, Total Quality Control, Total Quality Leadership, Quality Improvement, and Total Quality Management, to mention but a few. Although some quality proponents suggest that these terms represent different approaches to quality, there is no empirical evidence to support such a claim. Heady and Smith (1995), for example, conducted an empirical study of the topical differences between Total Quality Management (TQM) and Quality Management and came up with conclusion that TQM does involve the traditional characteristics of Quality Management, with some differences in the degree of attention to certain topics. In the present study the terms Total Quality Management and Quality Management are considered to be a synonymous. Use of the word "total" has been a subject of controversy. Kline and Coleman (1992) argue that there is no need for a prefix claiming that it is not clear what the opposite of TQM might be. In their words, no one is espousing "Partial Quality Management." Both Crosby (1992) and Deming (1994) would go as far to say that TQM is a meaningless phrase. While acknowledging that the word "total" is not necessary, in order to emphasize that quality improvement is a system that links all functional departments throughout the organization, a prefix "total" is added to term quality management and term TQM is used in this study. This seems to be appropriate for far too often construction companies have treated quality as a functional responsibility.

Total Quality Management Definition

The search for universal definition of Total Quality Management has yielded inconsistent results. The lack of a universal definition is the source of much controversy

and frustration. We define Total Quality Management (TQM) as a comprehensive company-wide effort dedicated to customer satisfaction through continuous improvement. In order to get an accurate picture of the actual impact of Total Quality Management initiatives on various aspects of business performance we need a detailed, unambiguous operational definition that allows a consistent, replicable, and valid measure.

To measure the degree of implementation of TQM we utilize an instrument developed by Saraph, Benson, and Schroeder (1989). Based on an exhaustive review and synthesis of the quality literature, Saraph, Benson, and Schroeder proposed a comprehensive set of critical factors that can be used to measure the extent of quality management in organizations. They identified eight critical areas of managerial planning and action that must be practiced to achieve effective quality management in a company. The eight critical factors identified are as follows:

1. The role of divisional top management and quality policy.
2. The role of the quality department.
3. Quality-related training.
4. Product/service design.
5. Supplier quality management.
6. Process management and operating procedures.
7. Quality data and reporting.
8. Employee relations.

The authors also developed an instrument to assess critical factors of quality management. The instrument contains several operational measures for each of the

factors, a total of 78 items. The complete list of items is presented in Appendix A. The authors suggest that these measures can be used independently or in combination to produce a profile of company quality management. The measures proposed were empirically based and tested and shown to be reliable and valid. The authors claim that the eight measures of the critical factors of quality management have content validity since selection of measurement items was based on exhaustive review of the literature and detailed evaluation of pretest subjects. The criterion-related validity of the instrument was evaluated by examining the multiple correlation coefficient computed for the eight measures and a measure of business unit quality performance. The quality performance measure was an average of the self-reported measure of quality performance and customer satisfaction with quality for the past three years. The multiple correlation coefficient was found to be 0.8, indicating that the eight measures have a high degree of criterion-related validity. Construct validity was evaluated by factor analyzing the measurement items of each of the eight critical factors. Seven factors were found to be unifactorial, while two subfactors emerged from the "process management and operating procedures" items.

The instrument developed by Saraph and associates is considered to be a relatively quick method to self-assess the extent of company Total Quality Management practice. It has been successfully used in several studies such as that of Motahari (1993) and Engelkemeyer (1991). While acknowledging that other sets of critical factors could be developed or that particular factors could be defined differently, the authors claim that this set captures most of the important aspects of effective quality management as advocated by leading practitioners and researchers.

Quality Background

Although product and service quality have been recognized as a crucial component of competitiveness, there is still little consensus about what "exactly" quality is and how it can be measured. Is quality objective or subjective, is it timeless, and does it have different meanings in different industries (Garvin 1984 b)? Those are but a few questions that need to be answered.

Few researchers have attempted to define and model quality because of the difficulties involved in delimiting and measuring the concept. Quality can take on different meanings, depending on who is defining the term. Two frameworks proposed by Garvin (1984b), and Dumas (1989) have emerged as the most comprehensive models fitting almost all existing definitions of quality. Figure 2-1 summarizes the two frameworks.

Quality Definitions (Garvin 1984 b)	**Quality Hierarchy (Dumas 1989)**
Transcendent	It develops
Product-based	↑ It satisfies
User-based	↑ It works
Manufacturing-based	↑ Extra features
Value-based	

Figure 2-1. Two Frameworks for Defining Quality

Garvin (1984 b) has identified five principal definitions of quality: (1) transcendent, (2) product-based, (3) user-based, (4) manufacturing-based, and (5) value-based. These five perspectives highlight distinctive aspects of the quality. Transcendent approach views

quality as synonymous with "innate excellence." Quality cannot be defined precisely; it is an unanalyzable property that we learn to recognize only through experience. Product-based approach, however, views quality as a precise and measurable variable. Differences in quality are primarily due to differences in the quantity of some ingredient or attribute possessed by a product. According to this approach, it is possible to assess quality objectively, based on more than preferences alone. User-based approach is best described by expression that quality "lies in the eyes of the beholder." This is rather personal view of quality, one that is highly subjective. According to this approach, the aggregation problem is usually resolved by assuming that high-quality products are those that best meet the needs of a majority of consumers. Manufacturing-based definition identifies quality as "conformance to requirements." Excellence is equated with meeting design specifications. A product that meets specifications is considered to be a quality product. Lastly, value-based approach views quality in terms of cost and prices. A quality product is one that provides performance at an acceptable price or conformance at an acceptable cost.

According to Dumas (1989) there are four levels in quality hierarchy. The lowest level is synonymous with "more features"; better quality is achieved by adding more features to a base product. This approach fails when customers realize that extra features are irrelevant if the base product is unreliable. At that point the definition of "it works", also expressed as "meet customer specifications" and "right the first time", replaces the definition of "extra features." At the next level quality is defined from the customer's perspective; it is expressed as "satisfy the customer" or "satisfy customer expectations". At the highest level, products and services develop customers by educating them and

exposing them to greater value from the products and services. According to Dumas, there is a correlation between the maturity of an organization's approach to quality management and the definition of quality used.

Quality in Construction

Before one can define methods for improving and maintaining the quality of construction, two fundamental questions need to be answered: Who sets the quality standards and what is a high quality in construction? There are, generally, two approaches to these questions in construction, conformance to requirements approach and customer satisfaction approach. The conformance to requirements approach is in line with Garvin's "manufacturing-based" and Dumas' "it works" definition of quality. This approach is to argue that it is a designer's and/or company's responsibility to define standards and set targets for performance. Customer satisfaction approach, on the other hand, defines quality in terms of meeting customer requirements. Quality is what customers say it is. This approach is in line with Garvin's "user-based" and Dumas' "it satisfies" definitions of quality. In the sections that follow, we discuss the two approaches in greater depth.

Conformance to Requirements Definition of Quality

Traditionally, construction industry has preferred conformance to requirements definition of quality where the major concern has been how well the constructed facility conforms to design specifications. This definition has become popular among both professional practitioners and the researchers associated with construction (see for example Davis et al. 1989; Mathews and Burati 1989; Oswald and Burati 1992). Some variations to the conformance to requirements definition found in literature include:

"conformance to specifications", "conformance to agreed requirements the first time every time", "meeting the specifications", "conformance to valid requirements", "meeting the requirements the first time", and "meeting established requirements". According to this approach, excellence is equated with meeting specifications and with "making it right the first time." It assumes that by providing a product which satisfies the design and specifications, it is of high quality. Any deviation from the established design or specification implies a loss of quality.

Conformance to requirements definition of quality demonstrates a number of very important attributes and strengths. Measuring quality by using this definition is relatively straightforward and easy (Reeves and Bednar 1994) for it is readily translatable into operational criteria (Seymour and Low 1990). It has been perceived, both by practitioners and researchers, as being "pragmatic" and "objective."

Conformance to requirements definition of quality, however meaningful, also possesses some inherent limitations. A serious weakness associated with this definition is that its primary focus is internal; it assumes that providing a facility which satisfies the design and specifications, as developed by a designer and interpreted and implemented by a constructor, it is of high quality. In many cases this quality paradigm has been proven inadequate. There is ample evidence that construction is not immune of technically incomplete and unsound designs and specifications. Burati et al. (1992 a) collected quality deviation data from nine fast-track industrial projects and found that in average 78 percent of all quality deviations were attributable to design. A research conducted in the United Kingdom on the technical quality of 15 housing projects with total of 769 housing units found an average of twenty-eight faults per house, half of which had their origin in design

or specifications (cited in Preiser 1988). Obviously, a contractor or home builder may easily end up doing the "wrong thing right way"; merely meeting design and specifications is by no means a guarantee for high quality. The issue becomes the quality of design and specifications, since they come to be viewed as a neutral touchstone against which quality in implementation is assessed.

Another limitation of conformance to requirements definition of quality is that it assumes that we can get stable and complete requirements; it ignores the potential mismatch between what is specified and what the customer needs. It is quite possible for a constructed facility to meet specifications, but fail to meet a user's needs and expectations. In fact, customers may not know or care about how well the constructed facility conforms to specifications; they want their needs and expectations to be met. The crucial task is how to establish design requirements and specifications that best reflect their needs and expectations. This is a particularly problematic step for non-technical requirements, such as aesthetics, comfort, and convenience, which usually are not completely addressed by specifications (Kenny 1988).

While the conformance to requirements definition is appropriate for the construction phase of a project, it is more problematic for the design phase which, by its nature, requires much judgment, discretion and creativity (Davis et al. 1989). There is also questionable usability of the definition for evaluation of service quality for it fails to address the unique characteristics of service (Reeves and Bednar 1994). This is especially true when a high degree of human contact is involved.

Considering limitations in the development, interpretation and implementation of design requirements and specifications, it is obvious that conformance to requirements

approach should not be used as the exclusive criterion for defining quality. As Seymour and Low (1990) pointed out, conformance to requirements definition is far too limiting and provides an incomplete vocabulary of quality. Without denying the importance of conformance to requirements approach, we also acknowledge that there is a need for a more robust view of quality.

Customer Satisfaction Definition of Quality

Improving customer satisfaction has been identified as one of the most important challenges facing businesses in the 1990s. For a company to compete effectively on the quality of its products and services "a deeper understanding to the customer's perspective is a necessary first step" (Garvin 1984 a, p.43). More robust view of quality comes with the customer satisfaction approach which places the emphasis upon the customer. It demands an entirely new perspective--one that calls for viewing quality externally, from the customer's perspective, rather than internally, from a quality-assurance point of view. According to that approach, quality is the extent to which a product or service meets a customer's expectations; quality is whatever the customer says it is. The serious limitation of this definition is its complexity; it is the most complex definition of quality and the most difficult to measure for different customers place different weights on the various attributes of a product and service.

Apparently, both conformance to requirements and customer satisfaction definitions of quality have strengths and limitations in relation to measurement, generalizability, and practical usefulness. They should not be seen as mutually exclusive; rather they should be viewed as complementary to each other. Conformance to requirements definition of quality has already established its position within the

construction industry, which is, certainly, not the case with customer satisfaction approach. The main premise of this study is that in the marketplace, quality must ultimately be evaluated from the customers perspective. Consequently, we define quality as customer satisfaction with a product and service received. This is in line with Ferguson's claim that customer satisfaction definition of quality must be added to the industry's conception of quality (Ferguson 1994).

Controversy Surrounding Total Quality Management Results

Total Quality Management (TQM) has evolved as a business philosophy with worldwide appeal and was seen as an universal cure for all organizational ills. The media have, however, been sending mixed messages about the actual impact of Total Quality Management initiatives on business performance and more and more criticism and accounts of failed efforts appeared in the literature. Some firms are delighted with the results of their TQM efforts, reporting significant improvements in outcomes such as market share, cost, and profits. Other firms, however, have expressed criticism concerning the effectiveness of their quality initiatives. For many of them TQM already has negative connotations. In the following section we will summarize some positive and negative findings concerning the effectiveness of TQM initiatives.

Positive Correlates of Total Quality Management to Business Performance

Managers are interested in quality primarily because of its marketing and financial implications. Consequently, vast majority of studies undertaken has been concerned with a question whether a strategy to improve product and service quality is profitable or not. One of the most widely cited studies that found positive correlation between high quality

and superior performance was that of Peters and Waterman (1982). They documented that the most profitable, well-managed US corporations emphasize product and service quality. These companies not only provided quality products and services but also ranked among the top in their respective industries in several financial criteria over a 20-year period. Several other studies have presented similar findings. A large-scale study conducted by the Strategic Planning Institute of Cambridge (Schoefler et al. 1974) found that quality is an important determinant of business profitability. Study on thirty companies that either applied for the Malcolm Baldrige National Quality Award (MBNQA) or were known to actively practice Total Quality Management showed that they experienced almost 200 percent larger growth in revenues as compared to industry average (Becker et al. 1994). In 1991, a study was conducted by the US General Accounting Office (GAO) (GAO 1991) to assess the impact of formal TQM practices on the performance of US companies. The GAO analyzed empirical data obtained from 21 MBNQA applicants and found that the participating firms attained somewhat better employee relations, improved their operating procedures, achieved greater customer satisfaction, and increased market share and profitability. In an extensive study of 200 of the largest US corporations, over 6,000 executives were asked to rate the reputations of the ten largest companies in America's 20 largest industries on eight attributes one of which was quality of products and services offered. It was found that the quality of products and services was the key predictors of high ratings (cited in Rehder and Ralston 1984).

Several studies about the effectiveness of quality management initiatives have been conducted within the construction industry, as well. Burati et al. (1991) conducted study

on 19 owner and contractor firms that were known to actively manage quality and found that all companies had documented cost benefits resulting from their quality-management efforts. McKim and Kiani (1995) studied 15 test projects that were split into two groups: one group consisting of eight framing contracts that used traditional construction management techniques and another group consisting of seven framing contracts that used Total Quality Management principles. The study suggests that the application of TQM principles can provide better construction than other management methods.

Negative Correlates of Total Quality Management to Business Performance

There is sufficient evidence that the quality programs of many companies are falling short of expectations. Study conducted by Wilkinson et al. (1995) found that more than 10 percent of the respondents reported adverse effects of quality management programs, particularly on productivity, cost, efficiency, profitability, and employee morale. Another survey conducted on 500 American manufacturing and service companies found that only 36 percent felt their total-quality programs were having a "significant impact" on their competitiveness (Economist 1992). In a study conducted by Rath & Strong Inc., 95 companies were asked to analyze whether their Total Quality Management efforts had met such goals as raising market share or increasing customer satisfaction. Only 26% of those initiatives rated an A or a B. Lackritz (1997) studied the success of quality management programs in 95 companies from the Fortune 500 list. Only two corporations believed their quality management programs were totally successful, with majority of respondents believing that their quality journey was still incomplete and admitting to falling short of total success in their quality implementation. Similar messages are coming from Europe,

as well. In a study of over 100 British firms a mere fifth of those surveyed believed their quality programs had achieved "tangible results" (Newsweek 1992).

Problem Statement

Construction industry shares a similar experience with other industries with respect to confusing results of Total Quality Management initiatives. Although many companies have a hard time acknowledging this point publicly, the results of most quality programs have fallen short of expectations. For many of them, quality initiatives turned out to be just another burden on the bottom line. Considering conflicting findings concerning the success of Total Quality Management programs, some companies began questioning the basic tenets of TQM. Is Total Quality Management as a business philosophy flawed or do the flaws lie in the implementation of TQM?

Construction industry has lagged behind other industries in studying the actual impacts of Total Quality Management on business performance. Empirical evidence of the success or failure of Total Quality Management practice in the construction industry is surprisingly scarce. The literature is full of prescriptions that offer various remedies to improve the quality of products and services. Most of these recommendations are, however, largely anecdotal. There is a need for more research to systematically assess and document the results of Total Quality Management. Such research will help us to fully understand the effects of TQM and to identify the factors that contribute to its success or failure.

This study is concerned with Total Quality Management practice in home building industry. More specifically, we study the link between TQM and home-buyer satisfaction. By gaining a better understanding of the relationship between TQM practice and home-

buyer satisfaction companies will be able to pinpoint areas requiring attention and action to increase home-buyer satisfaction through improved house and service quality.

Chapter Summary

In this chapter, we presented background on Total Quality Management movement. We addressed some inconsistency in usage of the term. Two prevailing approaches to quality in construction were discussed. It was accomplished by examining strengths and limitations of the two definitions, and by describing the trade-offs inherent in accepting one definition of quality over another. We concluded by presenting conflicting signals about TQM effectiveness. Such conflicting reactions imply that general understanding about TQM is becoming increasingly complex and enigmatic and that more research is needed.

In the next chapter, we will introduce a concept of customer satisfaction. The importance of the concept and the benefits to having satisfied customers will be discussed. Relationship between product and service quality and customer satisfaction is addressed, as well. We will discuss the credibility of customer satisfaction as an external criteria for evaluation of TQM program performance.

CHAPTER 3
CUSTOMER SATISFACTION

Background

With the age of quality has come the need to focus on customer satisfaction. The Total Quality Management (TQM) movement promotes customer satisfaction as the primary objective of successful organizations. Satisfied customers are said to be the backbone of the home building. The biggest shift in the building industry that has happened in the last several years is that builders are extremely interested in gaining customer input. Rather than guessing at and later trying to sell what they view as a quality house, many builders are systematically inquiring of customers what they consider acceptable quality (Lewis 1993). Builders have come to realize that the ability to correctly assess the desirability of their housing units and quality of service is crucial to their financial viability. Home buyers are already getting more demanding. They are more informed, more aware and more knowledgeable about what goes into the building process. They come in with high expectations that often go unmet. More knowledge about the factors which are related to home buyers' satisfaction, or dissatisfaction, would be an invaluable tool in achieving and maintaining a competitive edge.

In this chapter we discuss concept of customer satisfaction. The relationship between quality and customer satisfaction, as well as, the benefits of delivering high quality and high customer satisfaction will be addressed. We discuss the potential and

credibility of customer satisfaction as a criterion for assessing different aspects of company performance.

Customer Satisfaction Definition

Improving customer satisfaction has been identified as one of the most important challenges facing businesses in the 1990s. As industries and companies worldwide face increasing competition, slower growth rates, and price pressures, greater attention is being placed on customer satisfaction (Johnson and Fornell 1991). Thousands of academic and trade articles have been published on the topic. A recent survey reported that 90 percent of responding firms had customer satisfaction reflected in their mission statement (cited in Peterson and Wilson 1992). Home building is no an exception. Mission statements similar to those listed in Figure 3-1, below, are becoming the industry standards.

As delivering customer satisfaction is at an early evolutionary stage in most US companies, there is a great deal of opportunity for companies not yet concentrating on customer satisfaction to initiate successful programs (Griffin et al. 1995). Satisfying customers is becoming the ultimate virtue for many managers.

The traditional quality-control methods, tailored to manufacturing processes, were primarily interested in finding failures or defects before a product leaves a production facility. The main purpose was, clearly, to increase customer satisfaction by improving the quality of product delivered. Quantifying customers' satisfaction with these products, however, was not emphasized and thus it was not measured (Barsky and Labagh 1992). As a result, managers were in the position of not knowing if their firms were satisfying customers until customers were sufficiently dissatisfied to complain.

Company	Mission Statement
Mercedes Homes	*Our mission is to commit our energy and resources to providing our customers with the finest quality, beautifully designed house at affordable price, while delivering the highest level of customer satisfaction.*
Hallmark-Builders	*Hallmark Builders satisfies customers by creating a partnership with each homebuyer built on honesty, integrity and teamwork resulting in a home of superior quality and craftsmanship.*
Doyle Wilson Homebuilder, Inc.	*Our mission is to build homes of exceptional quality and value, and an organization that is committed to customer satisfaction.*
Oakwood	*Oakwood Homes provides the single most important objective-- "Homebuyer Delight" --before, during, and after the sale.*

Figure 3-1. Mission Statements Reflecting Commitment to Customer Satisfaction are Becoming the Industry Standards

With the Total Quality Management (TQM) movement customer satisfaction has become one of the primary objectives of successful organizations. Companies are becoming more interested in gaining customer input and in conducting a systematic and continuous assessment of actual levels of customer satisfaction. Quantifying customers assessment of product and services, should be an integral tool to achieving and maintaining a competitive edge.

There is still a great deal of inconsistency and ambiguity in the usage of the term customer satisfaction. This study is concerned with customers who purchase single-family houses for owner occupancy. We define customer satisfaction as the result of customer's subjective evaluation of the extent to which the house and service received fulfill the set of expected needs and wants. In order to accurately measure the degree of home-buyer satisfaction we had to develop unambiguous operational definition that allows for a

consistent , replicable, and valid measure of satisfaction. The development and testing of an instrument for measuring home-buyer satisfaction will be discussed in greater depth in Chapters 4 and 6.

Quality and Customer Satisfaction Relationship

The measurement aspect of customer satisfaction with product and service is a complex process that requires a clear understanding of the "true" relationship between quality and customer satisfaction. Framework proposed by Iacobucci et al. (1994) can help us accomplish that goal. According to this framework quality and customer satisfaction may be viewed in three different ways, as graphically shown in Figure 3-2.

Panels "A" and "C" represent the two extremes. Satisfaction and quality might be two unique concepts ("A") or they might be the same concepts ("C"). If it is possible to map out all four quadrants of the space depicted in panel "A" having all combinations of high and low quality and satisfaction, then the two evaluative judgments are unique concepts and indeed separable. For example, a home buyer might say "I can recognize this is a high quality house, but I do not like it." On the other hand, if customer satisfaction can only be achieved as a result of high quality performance and dissatisfaction as a result of poor quality, then the relationship between the two constructs may be visualized by the panel "C". Panel "B" views customer satisfaction and quality as correlated concepts. There is ample empirical support for quality as an antecedent of customer satisfaction (Anderson et al. 1994), resembling panel "B" as a "true" relationship between quality and customer satisfaction. Theoretical framework presented in this study views customer satisfaction and quality as distinct, however, closely related concepts.

Intuitive logic says the higher the satisfaction level, the better the product and service. This reasoning is in line with previously stated customer satisfaction definition of quality which is used in this study.

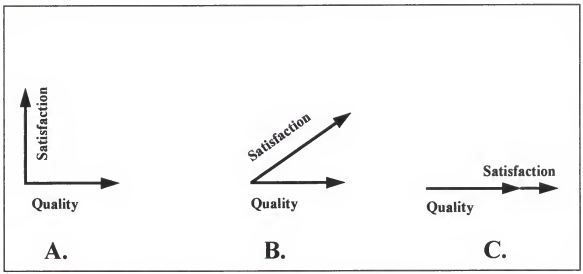


Figure 3-2. Three Possible Relationships Between Quality and Customer Satisfaction (Iacobucci et al. 1994)

Key Benefits of High Quality and High Customer Satisfaction

There are several key benefits of high quality and high satisfaction for a company. In general, high quality and customer satisfaction should increase profitability and positive word-of-mouth, enhance reputation for the firm, improve international competitiveness, and reduce litigation.

Economic returns. It is unlikely that firms will be willing to implement a customer satisfaction focus unless they believe that customer satisfaction will lead to more profitable, long-term business (Griffin et al. 1995). A growing body of evidence suggests that delivering high quality and high customer satisfaction is rewarded by economic

returns, confirming the appropriateness of this strategy. Consistently providing products and services that satisfy customers should increase profitability by reducing failure cost (Crosby, 1979; Garvin 1988). The findings support a positive impact of quality on customer satisfaction, and in turn, profitability (Anderson et al. 1994; Rust and Zahorik 1993). Return on investment (ROI), a long-term measure of economic health, is also strongly affected by customer satisfaction (Buzzell and Gale 1987; Anderson et al. 1994). Empirical findings, however, provide a preliminary indication of trade-offs between customer satisfaction and market share goals. In the long run, it is possible that customer satisfaction and market share go together, but there is growing evidence that this is not always the case in the short run (Anderson et al. 1994). Quality appears to have a measurable impact on a contractor's bottom line. A pilot study of more than 100 contractors in various types of construction, conducted by Corporate Development Services Inc., found that failures to adhere to basic quality standards reduce available gross profit margins for as much as 60 percent (PB 94b). There have been numerous instances in which homebuilders have reported remarkable results since implementing their quality programs. One home builder, for example, realized an increase in closing from 607 units to 709, revenues rose from $86 million to $100 million, and gross revenue per employee jumped 50% from 1991 to 1993 (PB 1994b).

Word of mouth. Satisfied customers are reputedly more likely to engage in positive word of mouth, and less likely to engage in damaging negative word of mouth, for the firm. Studies conducted by Ford Motor Company showed that satisfied customers tell eight other people about their cars, while dissatisfied customers complain to 22 people (Damon 1985). There is a saying that no information travels faster than that of unreliable

builders. Word-of-mouth, or referrals, referring to a word of a company passed from client to potential client, is a significant source of qualified new home buyers, particularly in a tight market. Builders have come to realize that a group of satisfied customers is the strongest sales force in the marketplace. A survey found that more than two-thirds of respondents felt that referrals were the most important method for selecting a contractor (PBR 1991). For some home builders customer satisfaction focus has already paid off. Several builders have reported a fascinating 100 percent referral-driven sales (Builder 95a).

Reputation. An increase in customer satisfaction also should enhance the overall reputation of the firm (Anderson et al. 1994). Once established, a reputation for remarkable product and service can be tapped to win new customers.

International competition. Various housing experts claim that the American building industry lags far behind its counterparts in Japan and Europe (Washington Post 1987). The degree to which foreign competition affects home builders in the United States is the subject of lively debate. There is, however, a consensus that foreign influences do exist today, they are growing and they are likely to continue to grow (PB 1988). More and more foreign housing firms have begun eyeing the US home building market as the next possible target for large-scale invasion (Washington Post 1987). The Japanese, for example, believe they can build a house cheaper and in half the time it takes to build in US (Builder 1988). Delivering high quality and high customer satisfaction is one of the most effective ways for winning new customers and for successfully competing with foreign firms.

Litigation. Construction related disputes are increasing at an alarming rate. Dissatisfied customers are more likely to take a legal action which may result in hundreds of thousands of dollars of loss for a builder. In a recent case, the Court of Appeals of California ruled that a home builder who sold a home with defects was liable for $50.000 in emotional distress damages to the purchaser (PB 1994a). In addition, the trial court awarded the purchaser $213,913 in property damages. A builder delivering high quality and high customer satisfaction, is less likely to be involved in a dispute with his customers which eventually positively impact his bottom line and reputation.

Customer Satisfaction as a Performance Criteria

Companies need assurance that their improvement efforts are organized and that their priorities are on the right track (Kelvin and Lynch 1992). Organizational efforts towards continuous improvement should be focused on creating performance measurement systems that provide relevant, factual information on core business processes and key activities (Miller 1992). One of the most significant changes in today's business is the shift from treating financial figures as the foundation for performance measurement to treating them as one among a broader set of measures (Eccles 1991). Recently a number of companies have begun to create new performance measurement systems that supplement and extend the more traditional financial measures of company performance. In response to changing markets, and concerns about a "short-term orientation," these firms have begun to use, so called, nonfinancial measures, such as quality and customer satisfaction (Eccles and Pyburn 1992).

The use of "soft" performance criteria, such as customer satisfaction, in construction is at an early evolutionary stage. Companies still track customer satisfaction less than they do individual project performance, overall company performance, or safety and estimating, for example (ENR 1995). The distinguishing characteristic of this study is that it facilitates customer satisfaction for evaluation of quality and ultimately for assessment of success of a company's Total Quality Management program. This is in line with Juran's call for new measures for quality:

> Unsuccessful companies did not develop new measures for quality in order to provide the executives with essential information on quality. Or, alternatively, unsuccessful companies focused exclusively on financial measures (sales, profits, ROI) and they lacked some essential measures of quality (measures of customer satisfaction, competitive quality). Lacking such measures, they learned of their quality problems only after severe damage had already been done. (Juran 1993b, p.37)

Still, most companies today use financial and accounting results as the ultimate measure of business performance (Eccles and Pyburn 1992). According to Eccles and Pyburn (1992), there are two inherent limitations in relying exclusively on financial measures of performance. Firstly, financial measures are lagging indicators; that is, they are the result of management action and company performance, not the cause of it. Consequently, they do little to predict future performance and do not provide much guidance for what must be done differently. The second limitation is their internal rather than an external focus.

One objection against the use of nonfinancial measures, such as customer satisfaction, is that we are in the domain of "soft" numbers. This seems to be a sound critique, for there is no universally accepted standard method of measuring customer satisfaction. Hence, the numbers are easily manipulated; even a small change in the

methodology can invalidate comparisons over time and across companies (Newman 1991). Engledow (1977), for example, questions the credibility of satisfaction as a stable measure of corporate performance. He supported his claim by pointing out that behavioral scientists generally agree that individuals do not possess a "satisfaction meter" that faithfully records satisfaction level. He would go as far to say that satisfaction is "a rubber yardstick", a highly unstable construct (Engledow 1977).

In isolation, neither financial nor nonfinancial measures can fully measure performance or fully describe how well the organization is doing (Miller 1992). The ultimate goal is to create a more comprehensive system of performance measurement that combines financial and nonfinancial measures in the right proportion and in the right way (Eccles and Pyburn 1992) so that they can be used to measure, as Hempel and Rosenberg (1976) call it, "total" performance.

Problem Statement

Quality improvement is difficult to achieve unless quality is accurately and periodically measured. One reason for that difficulty is the lack of good overall measures of quality in its broadest sense. Companies say they have difficulty even making a baseline assessment of their quality (ENR 1995). Consequently, Total Quality Management (TQM) remains a mystery to many top managers in the construction industry, and many are not even interested in getting involved.

To evaluate is to measure performance with respect to a criterion. In this study we choose home-buyer satisfaction as the criterion for measuring TQM performance. There are no "right" or "wrong" criteria; there are, however, criteria that when used, will be

more likely to provide answers to the questions one is asking. In this study we attempt to find answers to the following questions: (1) How to organize a TQM system that will allow for the highest home-buyer satisfaction to be achieved? and (2) What level of home-buyer satisfaction may be expected from a particular organizational or managerial action within the TQM system?

It is true that most of home builders do customer surveys. But too often there is no structure that ties customer satisfaction to internal business processes. The challenge is to design valid external measures, but report and use the results to drive internal organizations to improve quality performance, and ultimately to increase profitability. Customer satisfaction, as an external measure, can provide the strategic intelligence needed to direct the quality improvement effort. By determining how TQM affects customer satisfaction and which TQM factors correlate the most with customer satisfaction, builders can focus their activities on the most promising areas. The ultimate goal is "to ensure that the organization can recognize the extent to which it is achieving customer satisfaction, identify where and why deficiencies exist, and isolate problems that can be attacked systematically" (Lewis 1993, p.44).

Chapter Summary

In this chapter we introduced and analyzed the meaning of a concept of customer satisfaction. We argue that customer satisfaction does possess credibility and that it can be used as an external criterion for assessing the success of TQM initiatives. In the next chapter, we will establish a theoretical framework for modeling a concept of home-buyer

satisfaction. That model will be a point of departure in developing an instrument for measuring current level of home-buyer satisfaction.

CHAPTER 4
CUSTOMER SATISFACTION MEASUREMENT

Background

Quality and satisfaction are extremely important business concepts. To successfully compete long term, a company must be sure current customers are satisfied. To learn about how satisfied its customers are the company must periodically measure customer satisfaction. In construction, the extent of satisfaction, or dissatisfaction, is often known only late in the project when most of the customer's money has been spent. If a company knows how the attributes of a product or service affect customer satisfaction, the challenge of building market share would involve modifying current products and services in such a way that they would receive maximum customer satisfaction evaluation. There are, however, no commonly accepted methods of measuring customer satisfaction in the construction industry. One of the objectives of this study is to model and develop an instrument that will allow a home builder to not only evaluate home-buyers' satisfaction, but also to actively manage customer satisfaction through an organized and structured Total Quality Management (TQM) effort.

This chapter outlines the underlying premises for a customer satisfaction model presented in the study. We discuss the current conceptualization of product and service quality and customer satisfaction. Based on the proposed model for customer satisfaction, we develop an instrument for measuring home-buyer satisfaction.

Terminology

Before we can elaborate on a model of customer satisfaction, it is necessary to provide simple, conceptually sound definitions of customer, satisfaction, product and service.

Customer. The simplest available definition of a customer is "one who pays the bill" (Austin and Peters 1985). In the present study this type of customer is called a "paying" customer. Within the construction context, it is the owner or client. Another type of customer, equally important, is one who uses a product or service-- a "user" customer. Cooper (1974) was one of the first who made a distinction between the two types of customers. He pointed out that most facilities have been designed and built for a client other than the user: workers' housing by the factory owner and not the worker, hospitals by the technical staff and not the patients, schools by educators and not the students (Cooper 1974). The designer and contractor, paid by one client, design and build for another, the user. It is very important to make the distinction between the two types of customers for they use different sets of criteria against which they judge their satisfaction. This study is unique in that it deals with single-family house buyers who both purchase and live in their homes; that is, the home-buyer population represents both types of customers, paying and user customers.

Satisfaction. Current literature on customer satisfaction/dissatisfaction suggests that the primary antecedents of satisfaction are product and service performance and the customers' expectations regarding that performance (see for example Johnson and Fornell 1991; Barsky and Labagh 1992; Anderson et al. 1994; Swan and Combs 1976).

According to that paradigm, when purchasing a product/service the customer forms expectations concerning the future performance of the item. As the product/service is experienced, the customer compares the quality of performance to his/her expectations. If the product/service performs as well as, or better than, expected the customer will be satisfied. If, however, performance is below expectations, dissatisfaction will result. In the present study satisfaction is defined as the result of a comparison process in which actual product and service performance is compared with expectations.

Product and service. Two fundamental concepts used in this study are product and service. There is a great deal of inconsistency in the use of the terms in quality literature. Economists use the word "product" to represent the output of economic activity (Schwartz 1992). The term comprises two classes of product: the tangible product, or goods, and the intangible product, service. Sometimes the word "product" is used to include both goods and services, and in yet other instances, the word "product" is used for a goods product only and the word "service" is used for a services product. In such cases, the expression "product and service" usually refers to the combination of the economist's two kinds of products, goods and services (Schwartz 1992). In the present study we use terms product and service. The term product refers to economist's goods product definition. More specifically, the term product refers to the house, a physical dwelling unit. The term service, as used in this study, represents customer service provided by a company, before, during, and after the construction of the house.

Customer Satisfaction Model

As was pointed out earlier, current literature on customer satisfaction suggests that the primary antecedents of satisfaction are product and service performance and the customers' expectations regarding that performance. The general finding is that products/services that meet or exceed expectations receive favorable ratings on performance, while those that perform below expectations receive less favorable ratings.

A customer satisfaction model proposed in this study does not require that expectations, i.e., standards, exist prior to the product and/or service purchase. In that we agree with Iacobucci et al. (1994) who challenge the assumption that standards are used in all evaluations. They supported this conceptual criticism with Fornell's (1992) findings that indicated little relationship between expectations and satisfaction, but strong links between performance and satisfaction. Consequently, we theorize that customer (home-buyer) satisfaction is directly affected by product and service quality (i.e., their performance) regardless of whether a prior expectation exists or not.

Figure 4-1 shows a model depicting the relationships between a company Total Quality Management (TQM) practice, product and service quality, and customer (home-buyer) satisfaction. According to the proposed model: (1) improved product and service quality leads to increased customer satisfaction; and (2) house and service quality, and eventually customer (hom-ebuyer) satisfaction, are determined by the company TQM practice. If observed and managed in a structured fashion, the Total Quality Management system will lead to achieving higher house and service quality, which will eventually lead to improved customer (home-buyer) satisfaction. This view of the impact of TQM

practice on customer satisfaction is a cause and effect view. It holds that TQM practice is a major causal force in shaping the home buyer's satisfaction.

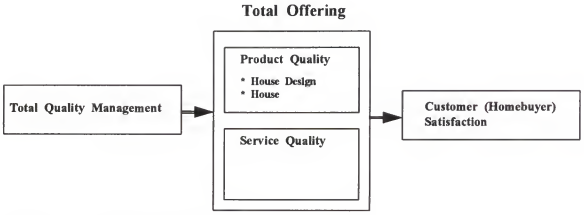


Figure 4-1. Customer (Home-Buyer) Satisfaction Model

The customer satisfaction model used in present study assumes that the relevant elements of home-buyer satisfaction extend beyond the house itself. Several studies have suggested that satisfaction depends not only upon the product itself, but also upon the experience surrounding the acquisition of the product (Hempel 1976). The price home buyers pay for a house is more than the price for bricks--it is a price for the product, including the service they get from home builder before, during, and after construction. Rarely are market offerings all products or all services but most often they are a blend of the two (Brown and Fern 1981). Every product and service must be designed, produced, and delivered in the context of a total package of products and services -- it is the "total offering" that generates the total degree of customer satisfaction. This is important to emphasize for far too often home builders have only looked at the core offering ("we are building homes") and have overlooked the service part of their offering.

Making distinction between product and service components of satisfaction is methodologically appropriate for satisfaction (dissatisfaction) does not appear to involve some form of compensatory judgment where poor performance on one dimension is balanced by good performance on another, and vice versa (Swan and Combs 1976). We further breakdown the product component of customer satisfaction into two dimensions: satisfaction with the house design and the house itself. We theorize that design of a product plays a major role in shaping customer satisfaction. In summary, our model anticipates that homebuyer satisfaction is affected by three distinct dimensions of home builder's total offering: house design, house, and service.

HOMBSAT--An Instrument For Measuring Home Buyer Satisfaction

The concept of customer satisfaction can be found in almost all major statements on the market economy. The absence of a generally acceptable operational definition of customer satisfaction appears to result in neglected implementation of this critical concept. In order to measure the extent of home-buyer satisfaction we had to develop an instrument, called HOMBSAT (HOMeBuyer SATisfaction), to enable structured observation and measurement of the concept.

Companies measure customer satisfaction in many different ways. Most surveys ask the customer to grade his or her satisfaction on a simple 1-10 scale. By using these scales, it is assumed that satisfaction ranges linearly between 1 and 10, where the highest value is usually labeled as "extremely satisfied" and 1 is labeled as "not at all satisfied. The label associated with the scale midpoint is usually something like "satisfied." Satisfaction

is, then, generally defined as the percent of customers rating their satisfaction higher than six (Babich 1992).

Operationally, customer satisfaction is a complex and elusive phenomenon (Peterson and Wilson 1992) that is not directly measurable by any observable variable. It is, however, indirectly measurable via a multiple-indicators approach (Johnson and Fornell 1991). Typically, a concept is rated on several scales representing items, or statements associated with a single dimension, and the results are averaged to provide a single score for each dimension. The summed scale score serves as an index of attitudes towards the concept.

How would one go about establishing a valid measure of an attitude such as customer satisfaction? In developing HOMBSAT, we followed a guideline outlined by Bohrnstedt (1970). According to Bornstedt, a concept under investigation, can be first stratified into major strata (components, dimensions, factors, or clusters), making as certain as possible that the stratification exhausts the meanings of the concept. One or more strata may further be divided into substrata if the stratum does not appear to represent a single dimension. Next, several items which are related to the same dimension can be written to capture the shades of meaning associated with each dimension. In the final step, the reliability and validity of the items generated need to be empirically tested.

Based on an exhaustive and thorough examination of the available literature we developed a model which views customer satisfaction as a composite, three-dimensional satisfaction with house design, house, and service. The next step is to generate statements or items to flesh out each of the three dimensions of home-buyer satisfaction.

Generating Items For HOMBSAT

It is seldom clear which attributes of a product and service performance are important to the customer and how those attributes are related to satisfaction. Which of the design, house and service attributes the home buyer perceives to be the most important? What are the relevant kinds of satisfactions toward which we should direct our attention? In this section we outline the theoretical foundation for the generation of items to capture the shades of meaning associated with three dimensions of home-buyer satisfaction.

Product Component of HOMBSAT

A house is a highly complex product that has numerous disparate qualities, each appealing to a diverse number of customers with different interests. What combinations of features or characteristics distinguish a "poor quality" house from one of "mediocre quality" or "excellent quality"? The following section discusses three frameworks, namely, Garvin's (1984b), Preiser's (1988), and Hartkopf's et al. (1986), that were helpful in generating items for a product satisfaction component of HOMBSAT.

The framework proposed by Garvin (1984b) was one of the first attempts to operationalize product quality. He outlined eight dimensions of product quality: performance, features, reliability, conformance, durability, serviceability, aesthetic, and perceived quality. Table 4-1 summarizes the eight dimensions.

Preiser (1988) proposed a framework for assessment of building performance through postoccupancy evaluation (POE). According to that framework three elements of building performance can be identified and treated hierarchically in their application to the

POE process: technical elements, functional elements, and behavioral elements. These elements are summarized in Table 4-2.

Table 4-1. Eight Dimensions of Quality (Garvin1984b)

PERFORMANCE	Performance refers to the primary operating characteristics of a product.
FEATURES	Features are the "bells and whistles" of products, those secondary characteristics that supplement the product's basic functioning.
RELIABILITY	Reliability reflects the probability of a product's failing within a specified period of time.
CONFORMANCE	Conformance is the degree to which a product's design and operating characteristics match preestablished standards.
DURABILITY	Durability is a measure of product life.
SERVICEABILITY	Serviceability represents the speed, courtesy, competence of repair, ease of repair.
AESTHETIC	Aesthetic represents how a product looks, feels, sounds, tastes, or smells. It is clearly matters of personal judgment, and reflections of individual preferences.
PERCEIVED QUALITY	Products may be evaluated less on their objective characteristics than on their images, advertising, or brand names.

Hartkopf, Volker, and Loftnes (1986) introduced the concept of "total building performance." They defined six fundamental building performance mandates: thermal comfort, acoustic comfort, air quality, lighting comfort, spatial comfort, and building integrity. According to them, one of the 1990s challenges is to understand the critical balance needed to simultaneously ensure all building performance mandates (Hartkopf, Volker, and Loftnes 1986).

Table 4-2. Three Elements of Building Performance (Preiser 1988)

TECHNICAL ELEMENTS	These elements include the survival attributes-structure, sanitation, fire safety, and ventilation. Additional elements include the performance of roofs, walls, finishes, illumination, acoustics, and environmental control systems, including heating and ventilation
FUNCTIONAL ELEMENTS	These elements directly support the activities within it, and they must be responsive to the specific needs of the organization and occupants, both quantitatively and qualitatively.
BEHAVIORAL ELEMENTS	These elements are concerned with the impact of a building upon the psychological and sociological well-being of the building occupants. For example, privacy can be experienced in various degrees depending upon design elements such as the configuration of walls, openings, and access.

Service Component of HOMBSAT

The quality of service may be the only factor that sets a builder apart from other builders who are offering similar homes for similar market segments (NAHB 1988). A survey revealed that 54 percent of new-home buyers said the salesperson positively influenced their decision to buy (Builder 1994). Which of the service attributes does the home buyer perceive to be the most important? The following section discusses three frameworks that were used as a departing point in modeling a service component of HOMBSAT.

According to Gronroos (1982) two types of service quality exist: technical quality, which involves what the customer is actually receiving from the service, and functional quality, which involves the manner in which the service is delivered. Lehtinen and Lehtinen (1982) view service quality as a three-dimensional concept consisting of: physical quality, which includes the physical aspects of the service (e.g., equipment or building);

corporate quality, which involves the company's image or profile; and interactive quality, which derives from the interaction between contact personnel and customers as well as between some customers and other customers.

Model developed by Parasuraman, Zeithaml and Berry (1985) is probably the most successful attempt to operationalize service quality. They documented 10 different determinants of perceived service quality: access, communication, competence, courtesy, credibility, reliability, responsiveness, security, tangibles, and understanding/knowing the customer. These are explained in detail in Table 4-3.

In the follow-up study (Parasuraman, Zeithaml, and Berry 1988) the authors developed a 22-item instrument, refining the 10 determinants of service quality to include five dimensions:

1. Tangibles - physical facilities, equipment, and appearance of personnel;
2. Reliability - ability to perform the promised service dependably and accurately;
3. Responsiveness - willingness to help customers and provide prompt service;
4. Assurance - knowledge and courtesy of employees and their ability to convey trust and confidence; and
5. Empathy - caring, individualized attention that the firm provides its customers.

Many factors affect customer satisfaction, some of which are under company's control (for example, product and service quality; a general image of a company), and others which are not (for example, competitors' strengths and weaknesses). Two requirements were established in developing the HOMBSAT instrument. Firstly, since the objective of the study is to determine how a company's TQM practice affects customer satisfaction, it is of utmost importance to include in HOMBSAT none of factors that may

influence customer satisfaction, but that are not under builder direct control. House quality component, for example, as used in this study, reflects the quality of the house alone, without reference to the neighborhood or location. For the same reason, the use of characteristics of the residents such as income, age, or education were excluded from the consideration. The second requirement in developing HOMBSAT was to include items of a fairly general nature so that the respondents did not need a detailed memory or highly specialized knowledge. The items generated relate specifically to the home building industry and are free of complicated terms. They were critically reviewed for their clarity and content by a variety of industry practitioners and faculty and graduate students from the M. E. Rinker, Sr., School of Building Construction at the University of Florida.

Number of Items

Important consideration in the development of any survey instrument is how many items need to be generated for any particular dimension of the concept under investigation. Although it is impossible to specify exactly how many statements to include, it is always preferable to construct too many items rather than too few (Carmine and Zeller 1979). Gorsuch (1983), for example, recommends at least 4 and preferably 6 items per dimension (i.e., factor), because it is generally difficult to replicate factors with fewer variables. Based on an exhaustive and thorough examination of the available literature we generated 83 items, 36 items representing the house design, 17 items representing the house, and 30 items representing the service component of satisfaction. A copy of the questionnaire used to measure home-buyer satisfaction, with a complete list of 83 items, is shown in Appendix B.

Table 4-3. Determinants of Service Quality (Parasuraman et al. 1985)

RELIABILITY. Reliability involves consistency of performance and dependability. It means that the firm performs the service right the first time. Specifically, it involves: accuracy in billing; keeping records correctly; performing the service at the designated time.
RESPONSIVENESS. Responsiveness concerns the willingness or readiness of employees to provide service. It involves timeliness of service: calling the customer back quickly; giving prompt service (e.g., setting up appointments quickly).
COMPETENCE. Competence means possession of the required skills and knowledge to perform the service. It involves: knowledge and skill of the contact personnel; knowledge and skill of the operational support personnel.
ACCESS. Access involves approachability and ease of contact. It means: the service is easily accessible by telephone (lines are not busy and they don't put you on hold); waiting time to receive service is not excessive; convenient hours of operation; convenient location of service facility.
COURTESY. Courtesy involves politeness, respect, consideration, and friendliness of contact personnel (including receptionists, telephone operators,); consideration for the consumer's property (e.g., no muddy shoes on the carpet); clean and neat appearance of public contact personnel.
COMMUNICATION. Communication means keeping customers informed in language they can understand and listening to them. It involves: explaining the service itself; explaining how much the service will cost; explaining the trade-offs between service and cost; assuring the consumer that a problem will be handled.
CREDIBILITY. Credibility involves trustworthiness, believability, honesty. It involves having the customer's best interests at heart. Contributing to credibility are: company name; company reputation; personal characteristics of the contact personnel; the degree of hard sell involved in interaction with the customer.
SECURITY. Security is the freedom from danger, risk, doubt. It involves: physical safety; financial security; confidentiality.
UNDERSTANDING / KNOWING THE CUSTOMER. Understanding/knowing the customer involves making the effort to understand the customer's needs. It involves: learning the customer's specific requirements; providing individualized attention.
TANGIBLES. Tangibles include the physical evidence of the service: physical facilities; appearance of personnel; tools or equipment used to provide the service; physical representation of the service; other customers in the service facility.

Rating Scales

The next task was to devise appropriate rating scales to measure customers' perceptions with respect to each item. To measure home buyers' perception about design/house/service quality, the semantic differential (SD) scale was constructed for each item. The semantic differential rating scale was chosen because of its simplicity and flexibility. There is a disagreement among researchers over how many points there should be on rating scales. Some researchers favor a seven-point or even an eleven-point scale, while others maintain that a four- or five-point scale is adequate. A seven point Likert-type scale was used in this study. Home buyers were asked to indicate the extent of satisfaction with each of the pre-determined attributes as described by questionnaire items. To facilitate the rating of intensity, SD scale positions were labeled. General findings suggest that the labeled scales are better understood by the respondents and lead to greater cooperation in the rating task (Heise 1969). An example of a scale used in this study is shown in Figure 4-2.

How satisfied are you with illumination level or quantity of light in your house?

Very Dissatisfied	Dissatisfied	Somewhat Dissatisfied	Neither Dissatisfied Nor Satisfied	Somewhat Satisfied	Satisfied	Very Satisfied
1	2	3	4	5	6	7

Figure 4-2. A Typical Scale From Questionnaire Used to Measure Home-Buyer Satisfaction

A scale like this one measures both directionality and intensity of a reaction. The seven labels appear to define rating positions which are about equidistantly spaced, which is a prerequisite for an accurate measurement.

Chapter Summary

In this chapter we proposed a model that relates Total Quality Management practice to customer (home-buyer) satisfaction. We presented several theoretical frameworks that were used as foundation for development of HOMBSAT instrument for measuring home-buyer satisfaction. The process of instrument development resulted in generation of 83 items which are related to three dimensions of home-buyer satisfaction. In the next chapter we will summarize the research methodology used in the present study. Major steps undertaken in the study will be outlined, with detailed discussion about Total Quality Management survey.

CHAPTER 5
RESEARCH METHODOLOGY

Introduction

This is an exploratory study focused on two increasingly important business concepts: Total Quality Management (TQM) and customer satisfaction. We want to examine empirically the relationship between critical factors of TQM and company quality performance as measured by customer perception of product and service quality. A flow-chart shown in Figure 5-1 summarizes major steps undertaken in this study.

In the first stage, the theoretical foundation for the research was established. Next, we determined the research design and data collection method. In order to gather data we had to conduct two separate surveys. First, a survey about home builders' Total Quality Management practices was administered. As a part of the TQM survey, companies were asked to provide a complete listing of home buyers who purchased and moved into their homes during a pre-specified period. Obtaining names and addresses of companies' customers was the prerequisite for the administration of the second survey - a home-buyer satisfaction survey. In order to gather data and assess home-buyer satisfaction we had to develop an instrument, called HOMBSAT. Once the data were collected, we were ready to proceed with data analysis. In this chapter we summarize the theory foundation, research design and data gathering method used in the present study.

In addition, the Total Quality Management survey is discussed in detail. The customer satisfaction survey will be covered in Chapter 6, followed by data analysis in Chapter 7.

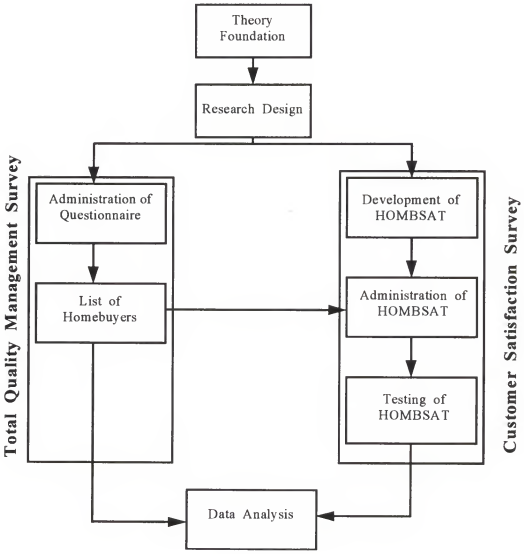


Figure 5-1. Flow-Chart of Research Methodology

Theory Foundation

The literature on quality indicates that researchers and practitioners are interested in the elements of Total Quality Management (TQM) as well as the benefits of the TQM

programs. The prevailing quality paradigm is that a commitment to TQM will result in many benefits, such as higher productivity, lower costs, higher profits, and increased customer satisfaction. However, the media have been sending mixed messages about the actual impact of TQM initiatives. Some companies are delighted with the results of their TQM programs, while others have expressed frustration concerning the effectiveness of their quality programs. Such conflicting signals imply that general understanding about quality is becoming increasingly complex and enigmatic.

This study investigates the nature and strength of the link between TQM and customer (home-buyer) satisfaction. We asked the following questions: How can we measure home-buyer satisfaction? What factors are important in shaping home-buyer satisfaction and what is its relative weight? How do they relate to each other? How does TQM affect home-buyer satisfaction? What aspects of TQM are the most highly related to home-buyer satisfaction? What areas of improvement will have the greatest impact on home-buyer satisfaction?

No large-scale study to date has attempted to measure the extent of TQM practice in home building industry, and relate that to specific measures of company performance. Such a study would empirically determine the tangible benefits of a commitment to TQM. This study is concerned with home builders' quality performance. The performance criteria used is home-buyer satisfaction. The selection of an external measure of quality performance rather than an internal quality measure is consistent with the philosophy of TQM, in which the ultimate goal is customer satisfaction. By gaining a better understanding of the relationship between TQM practice and customer satisfaction, and by knowing which aspect of TQM practice has the greatest impact on customer satisfaction,

management actions can be orchestrated in such a way that product and service receive maximum customer satisfaction evaluation.

Research Design

Survey is undoubtedly the most commonly used research design. It relies on self-reports of factual data, as well as opinion (Flynn et al. 1990). In this study we utilized survey as research design with a questionnaire used as a data collection method. We choose a questionnaire because of its directness and ease of administration and interpretation.

Total Quality Management Survey

In order to study the extent of Total Quality Management (TQM) practice employed in home building, we need a detailed, unambiguous definition of TQM that provides enough information to allow consistent, replicable, and valid measurement. Two models have emerged as the most promising attempts to operationalize concept of TQM, a model proposed by Saraph, Benson, and Schroeder (1989), and the Malcolm Baldridge National Quality Award (MBNQA) guideline.

Based on a thorough review and synthesis of the quality literature, Saraph, Benson, and Schroeder (1989) proposed a comprehensive set of critical factors that can be used to measure the extent of quality management in organizations. They identified eight separate critical areas of managerial planning and action that must be practiced to achieve effective quality management in a business unit. The eight critical factors identified are as follows:

1. The role of divisional top management and quality policy.

2. The role of the quality department.
3. Quality-related training.
4. Product/service design.
5. Supplier quality management.
6. Process management and operating procedures.
7. Quality data and reporting.
8. Employee relations.

The authors developed an instrument to assess critical factors, as well. The instrument contained operational measures, i.e., items, for each of the factors, a total of 78 items. The authors suggested that these critical factors could be used independently or in combination to produce a profile of company quality management. The measures proposed were empirically based and tested and shown to be reliable and valid. Although acknowledging that other sets of critical factors could be developed or that particular factors could be defined differently, the authors claim that this set captures most of the important aspects of effective quality management as advocated by leading practitioners and researchers.

The Malcolm Baldrige National Quality Award (MBNQA) is another comprehensive guideline that can be used to evaluate company's total quality management system. Judging is based on seven major criteria that are deemed essential to any quality improvement program. The relative importance for the 1997 MBNQA criteria is expressed in points (totaling 1000), as follows (Bemowski 1996): leadership (110 points), strategic planning (80 points), customer and market focus (80 points), information and

analysis (80 points), human resource development and management (100 points), process management (100 points) and business results (450 points). The MBNQA requires a major time and financial commitment on the part of companies in order to present and evaluate the information regarding their Total Quality Management practice. On the other hand, an instrument proposed by Saraph and associates is considered to be a relatively quick method to assess the extent of current TQM practice. The instrument has been successfully used in several large-scale studies (see for example: Motahari 1993; Engelkemeyer 1991). Consequently, we choose that instrument to measure the extent of TQM practice in home building.

Total Quality Management Questionnaire

A customized version of an instrument developed by Saraph et al. (1989) was used to gather data about Total Quality Management practice. The modifications included minor alterations of the wording of some questions in order to make them more uniform and easily understood. The items relate specifically to home building and are free of complicated terms. The items were critically reviewed for their clarity and content by a variety of industry practitioners and faculty from the M. E. Rinker, Sr., School of Building Construction at the University of Florida. Seven items were deleted from the original questionnaire due to the lack of applicability to the home building industry (items 31, 48, 51, 52, 57, 58, and 59), resulting in an instrument with 69 statements. A comparison of original and modified items that are used in this study is presented in Appendix A.

To enable respondents to indicate the extent of current practice of each item by their business unit, a 5-point Likert-type interval-rating scale was used. A typical questionnaire item is shown in Figure 5-2.

Extent of reliance on a few dependable subcontractors/suppliers?

Not Applicable **N/A**	Very Low **VL**	Low **L**	Moderate **M**	High **H**	Very High **VH**
☐	1	2	3	4	5

Figure 5-2. A Typical Questionnaire Item From TQM Questionnaire

A "Not Applicable" (N/A) mark was added in order to improve the quality of information obtained. It is used as a criterion for elimination of items that have more than 30 percent of "N/A" responses. The cutoff of 30 percent was arbitrarily determined. It was believed that items that are not applicable to more than 30 percent of sampled builders should not be included in an instrument that is supposed to generically represent the homebuilding industry.

For each of eight critical factors, the actual level of practice can be represented by the average of the measurement item ratings for that factor. These averages are referred to as factor scores. A vector of the averages for the eight factors can be used as a profile of the company's actual level of TQM practice.

Population and Sample Selection

This study was conducted in the home-building segment of the construction industry, Federal SIC code 1521. The primary unit of analysis was a business unit, which is defined as a segment of the company with separate management and non-overlapping customers. Depending on company organization, a business unit may represent the entire company, a branch, or a division.

The Florida Trend (March 1996) list of the 50 largest home builders in Florida was used to select potential participating companies. These companies can be classified as medium to large companies with the number of built homes ranging from several hundred to several thousand per year. Twenty companies were randomly selected from the list. Before mailing a survey package, the president or a high-level division manager in each company was contacted by telephone to request participation in the study. We explained the scope and purpose of the research emphasizing the confidentiality of the study. Companies were also asked to provide complete lists of home buyers who purchased and moved into their homes during the period August 1995 through October 1995. That requirement was considered to be one of the most demanding and required very careful handling. The companies were assured that all information would be held confidential and that data would only be reported in the aggregate. As a way of showing appreciation, each company was promised a detailed evaluation of its TQM performance, as well as an assessment of where the company stands in comparison with its competition. Sixteen companies agreed to participate in the study. Given the time and financial constraints, a sample of 16 companies was considered to be reasonably large. Consequently, we terminated our search for additional companies.

Administration

The process of administrating the Total Quality Management survey and collection of the completed questionnaires began in early April 1996 and took approximately four weeks. Each company was asked to provide 5 employees to evaluate current level of TQM practices in a business unit. The survey packets consisting of 5 copies of the questionnaire, a cover letter, and a postage paid return envelope were mailed to the top

executives of each company. The letter was personally signed by the researcher. A copy of the cover letter used in the TQM survey is provided in Appendix C.

In defining the respondent group, one must consider not only how many people from each company to include in the survey, but also who will supply the best information. A decision had to be made as to what people at what level in company hierarchy have the best possible information about the company's TQM practices. The president or a high-level division manager in each company agreed to be the contact person in the respective participating company. It was left to this person's discretion to choose the additional four employees most familiar with the quality practices of the business unit to complete the questionnaires. Respondents rated their perceptions regarding the extent of implementation of TQM in a business unit. Eight scores, $F1_i$, $F2_i$, $F3_i$, $F4_i$, $F5_i$, $F6_i$, $F7_i$, and $F8_i$, representing 8 critical factors of TQM were computed for each respondent (i=1-5). They were then averaged for all 5 employees, which resulted in the 8-dimensional vector (F1, F2, F3, F4, F5, F6, F7, F8), representing each respondent company's TQM profile.

Administration and collection of completed questionnaires for the TQM survey was a complete success. A total of 80 questionnaires (16 companies x 5 employees = 80 responses) were completed and returned, constituting a response rate of 100%. Companies also provided required lists of home buyers for a pre-specified period so that the home-buyer satisfaction survey could be initiated. Processing and analyzing the data obtained from the home-buyer survey is discussed in Chapter 7.

Chapter Summary

This chapter outlined a research methodology used in this study. We discussed the administration of Total Quality Management survey. One of the requirements for each participating company was to provide a complete list of home buyers for the period August 1995 through October 1995. The rationale for choosing that time frame will be discussed in the next chapter. The next chapter will also discuss the administration of the customer satisfaction survey. A major part of this discussion involves testing of the HOMBSAT instrument. It will be shown that the HOMBSAT demonstrates high reliability and validity, and that it can be used as a credible instrument for measuring home-buyer satisfaction.

CHAPTER 6
CUSTOMER SATISFACTION SURVEY

Introduction

Customer satisfaction is most typically measured through surveys with questionnaires being most commonly used data collection method. Benefits to using customer surveys are twofold (Peterson and Wilson 1992). They not only provide formal feedback to a company but also send a positive signal to customers that the company is interested in them. Some experts have, however, objected using surveys to gain a sense of home-buyers satisfaction. They argue that home buyers themselves are not a reliable and valid source of information about their satisfaction. They question the home buyers' ability to properly evaluate many of the survey items, simply because they do not buy a lot of homes (Builder 1995b). We challenge this critic. We assume that home buyers are able to report their feelings of satisfaction relatively accurately. As a key performance measure, customer satisfaction must be quantified and expressed at its source--by the customer. Only then can a company measure accurately what customers really want and what customers think of current products and services.

HOMBSAT--An Instrument For Measuring Home Buyer Satisfaction

It is true that most of home builders do customer surveys. But too often the survey is conducted, results are tabulated, and nobody knows what to do next because there is no structure that ties customer satisfaction to internal business processes. The

challenge is to design valid external measures, such as customer satisfaction, and to report and use the results to drive internal organizations to improve business performance, and ultimately to increase profitability. With this in mind we proceeded with developing an instrument for measuring home-buyer satisfaction, called HOMBSAT.

Based on an exhaustive examination of the available literature we proposed a model which views home-buyer satisfaction as a composite, three-dimensional, satisfaction with house design, house, and service received. We then generated a list of items to capture the shades of meaning associated with each dimension of home-buyer satisfaction. The items were critically reviewed for their clarity and content. This process resulted in the generation of 83 items, 36 items representing house design, 17 items representing house, and 30 items representing service component of HOMBSAT.

The next step in development of HOMBSAT was to devise appropriate rating scales to measure home buyers' perceptions with respect to each item. A seven point Likert-type scale was constructed for each item. The semantic differential rating scale was chosen because of its simplicity and flexibility. To facilitate the rating of intensity, scale positions were labeled. The seven labels appear to define rating positions which are about equidistantly spaced, which is a prerequisite for an accurate measurement. An example of a scale used in this study is given in Figure 6-1:

How satisfied are you with illumination level or quantity of light in your house?

N/A	Very Dissatisfied	Dissatisfied	Somewhat Dissatisfied	Neither Dissatisfied Nor Satisfied	Somewhat Satisfied	Satisfied	Very Satisfied
□	1	2	3	4	5	6	7

Figure 6-1. A Typical Item From HOMBSAT

A "Not Applicable" (N/A) mark was added in order to improve the quality of information obtained. It is used as a criterion for elimination of items that have more than 30 percent of "N/A" responses. The cut-off of 30 percent was arbitrary determined. It was assumed that items that are not applicable to more than 30 percent of home buyers should not be included in an instrument that is supposed to be generic- applicable across a broad spectrum of home buyers.

Questionnaire for Measuring Home Buyer Satisfaction

The final 10-page questionnaire used in home-buyer satisfaction survey is organized into four parts: Part One consists of general questions pertaining to the home purchase process; Part Two consists of questions pertaining to the house unit; Part Three is the HOMBSAT instrument itself consisting of 83 items; and Part Four includes demographic data. The questionnaire length of 10 pages is in line with Dillman's recommendation that an optimal length for a questionnaire is 10-12 pages (Dillman 1978). According to Dillman, there is no difference in response rates for various questionnaire lengths below 12 pages, or about 125 items.

Before being administered, the draft questionnaire was pretested among a convenience sample of 20 recent new-home buyers in Gainesville, Florida. The purpose of pretesting was threefold: to provide feedback on how easy the questionnaire is to complete; to identify items which are unclear or out of the respondents' range of knowledge; and to determine the time required to complete a questionnaire. Pretesting resulted in a minor questionnaire revision making it more user-friendly. The questionnaire

takes about 20 minutes to complete. A customer satisfaction survey packet, consisting of a cover letter, two follow-up letters, and the questionnaire, is provided in Appendix B.

Home-Buyer Satisfaction Survey Administration

At that point, the questionnaire was ready to be administered to gather empirical data about home-buyer satisfaction. In addition, the data obtained will be used for testing the questionnaire's reliability and validity. Subjects of analysis in the home-buyer satisfaction survey were individuals--new-home buyers. The lists of single-detached home owners were obtained directly from companies that participated in the study. Each company was asked to provide a listing of all home buyers who moved into their houses during the period August 1 through September 30, 1995. Only owners of homes which were designed by the home builders were included in the study. For companies that had more than 40 qualified customers for the specified period, 40 home buyers were randomly selected and survey package was mailed to them only. Eight companies had less than 40 qualified home buyers on their lists and a survey package was sent to all home buyers from these lists.

Timing of Measurement

A crucial, and very often overlooked, aspect of customer satisfaction is the question of timing of measurement. Subjective responses seem to be highly unstable over time (Gutman and Westergaard 1974). Engledow (1977, p.91), for example, views customer satisfaction as a "time dependent variable." Indeed, it appears to be a relationship between the level of customer satisfaction obtained in a study and the timing of the measurement (Peterson and Wilson 1992). The crucial question is: What would be

the most appropriate time to measure customer satisfaction? Is it the single measure taken at the end of the product's use, or is it a series of measures through the life of the product (Engledow 1977)? There is, however, no clear answer to that question. Some authors claim that better measures of satisfaction are obtained immediately after purchase whereas others hold that satisfaction should not be measured until customers have experienced the purchase for an adequate period of time (Peterson and Wilson 1992). Whatever is the case, it is of utmost importance to have timing variable controlled. We set a requirement that all home buyers included in study had had to live in their homes for approximately same period of time. Hence, home buyers who had been occupying their homes for 8-10 months during the period August 1995 through May 1996 were chosen for the study. In that way, every participating company was represented with home buyers who had experienced their homes and services for about the same period of time.

The requirement that home buyers had had to live in their homes for period of 8-10 months seems to be reasonable. It complies with two important criteria: the period of experiencing house and service should not be too long because of possible negative impact on home buyers' ability to accurately express their level of satisfaction with service received. The service experience starts months before contract is signed; 10 months of living in house may easily mean 18 months or more of service experience. On the other hand, the period spent in house should be long enough to allow homeowners to develop a sense about their satisfaction about house quality. A very influential factor in shaping one's satisfaction is the frequency and extent of potential problems that may take place after moving into a house. According to a study released by Federal Trade Commission (FTC) 63 percent of the new households reported problems occurring during the first 6

months, with additional 25 percent during the second 6 months (cited in NAHB 1988, p.35). Consequently, the period of 8-10 months of house occupancy is considered to be appropriate. The rationale for allowing a time frame extending over three months is that very few home builders build more than 10-15 homes per month. Initially, we defined a target size for home-buyer sample to be 20. With anticipated response rate of 50 percent, we needed to contact at least 40 home buyers in order to get 20 questionnaires returned. A period of three months seemed to be the shortest possible time to sell more than 40 housing units for majority of participating companies.

Questionnaire Administration

The process of distributing the survey and collecting the completed questionnaires began in late April 1996 and took approximately six weeks. To maximize both the quantity and quality of responses, attention was given to every detail that might affect response behavior. Proven methods to increase response rate were implemented in order to maximize the number of respondents.

The survey package, which included a questionnaire, a cover letter, and a postage paid return envelope, was mailed first-class to the sample of recent home buyers representing each participating company. The cover letter was printed on the University of Florida letterhead stationery and addressed to the individual home buyer. This was in line with the findings that university sponsorship had a significant advantage over commercial sponsorship (cited in Kanuk and Conrad 1975). The letter explained that participation was voluntary and that all answers would be confidential. The importance of the respondent's reply to the study was stressed. The letter included individual salutations

and was personally signed by the researcher. A sample of the cover letter is provided in Appendix B.

One week after initial mailing, a follow-up letter was sent to all home buyers, thanking those who had already responded and stressing the importance of each individual's reply to study. Questionnaires were stamped with individual identification numbers so that follow-up mailings needed be sent only to those not responding to earlier mailings. During the third week after initial mailing another mailing was sent to individuals who still had not responded. This mailing included a replacement questionnaire and a cover letter that again stressed the importance of each reply. Copies of the cover letter and two follow-up letters are provided in Appendix B.

A total of 545 questionnaires were distributed, and 295 were completed and returned with the overall response rate of 54.2 %. Given the nature of study, and the length of questionnaire, it was considered to be a high to very high return rate. A summary of the customer satisfaction survey is shown in Table 6-1.

Testing of HOMBSAT Instrument

In the previous sections we have delimited the domain of the home-buyer satisfaction concept and described the generation of a survey instrument items. The section that follows addresses methods used to establish validity and reliability of the instrument.

The data collected by surveys and other empirical designs are of little use unless its reliability and validity can be determined. The goal of science is to explain relations among variables (Bohrnstedt 1970). To accomplish that goal it is very important to

measure variables with as little error as possible. Two broad categories of errors that affect empirical measurements are: random (chance) error and nonrandom (systematic) error (Carmines and Zeller 1979). An individual's observed score X_i on an individual item can be defined as: $X_i = T_i + e_i$, where T_i represents true score, and e_i represents a random error in measurement (Bohrnsteadt 1970). The assumption is that positive and negative errors cancel each other in the long run; that is, the expectation of the errors is zero.

Table 6-1. Home-Buyer Satisfaction Survey Summary

	Comp. Code	No. of Question. Sent out (May '96)	No. of Question. Received	No. of Question. Unclaimed	No. of Question. Follow-up (June '96)	No. of Question. Received Follow-up	Total No. Received	Incompl. Question.	Total No. Retained for Statistical Analysis
1.	1	40	13	2	20	3	16	1	15
2.	2	40	21	2	0	N/A	21	2	19
3.	3	32	14	1	15	3	17	N/A	17
4.	4	40	14	4	15	4	18	N/A	18
5.	5	29	16	1	13	4	20	2	18
6.	6	30	12	1	15	5	17	2	15
7.	7	40	25	2	0	N/A	25	8	17
8.	8	37	22	2	0	N/A	22	5	17
9.	9	40	12	2	20	4	16	N/A	16
10.	10	40	16	1	10	3	19	1	18
11.	11	34	16	1	10	3	19	N/A	19
12.	12	26	11	1	14	4	15	N/A	15
13.	13	40	16	0	15	2	18	1	17
14.	14	40	20	0	0	N/A	20	N/A	20
15.	15	30	11	1	15	4	15	N/A	15
16.	16	27	12	0	15	5	17	N/A	17
	Total:	565	251	21		44	295 *(52%)*	22	273

There are two basic properties of empirical measurements: reliability and validity. The amount of random error is inversely related to the degree of reliability of the

measuring instrument (Carmines and Zeller 1979). Unlike random error, nonrandom error has a systematic biasing effect on measuring instruments, and is directly related to the instrument validity (Carmines and Zeller 1979). To test the reliability and validity of the HOMBSAT, home-buyer data representing different companies were pooled together. Two modifications of original data set took place. We eliminated items 68, 69, 70, and 78 from the original data set for having more than 30% of "Not Applicable" responses. The elimination of items is appropriate because the HOMBSAT is designed to be a generic application across a broad spectrum of home buyers. Second modification of the data set was the elimination of 22 cases, a case representing a set of an individual's responses on 83 items, for having more than 10 missing values. These two modifications resulted in the data set consisting of 273 cases with responses on 79 items. Missing values for individual cases were replaced by mean value of one of the three dimensions, rounded to a whole number, for that particular case. Testing of the HOMBSAT instrument was done using SPSS statistical package.

Validity

Validity indicates the degree to which an instrument measures what it purports to measure (Bohrnstedt 1970). Three types of validity were examined to evaluate HOMBSAT: content validity, convergent validity, and construct validity.

Content Validity

An extensive literature search lies at the very heart of content validity. Content validity cannot be determined statistically. Rather, it is a judgment, by experts, of the extent to which an instrument truly measures the concept that is intended to measure

(Flynn et al. 1990). The HOMBSAT was developed after an exhaustive review of the literature. A thorough search and examination of the literature suggested that home-buyer satisfaction may be conceived of in terms of the three dimensions: satisfaction with house design, house unit and service received. In order to flesh out the three dimensions of home-buyer satisfaction 83 items were generated. At that stage, the input was solicited from housing experts and others involved in the housing market to clarify some of the concepts and to make the items more understandable. The items for each dimension were critically reviewed for their clarity and content by a variety of industry practitioners and faculty and graduate students from the M. E. Rinker, Sr., School of Building Construction at the University of Florida. We argue that the three measures of the home-buyer satisfaction developed in this study have content validity since selection of measurement items was based on both an exhaustive review of the literature and detailed evaluations by academicians and practicing professionals.

Construct Validity

Examining the construct validity of the retaining 79-item instrument was the next task in the process of establishing the instrument validity. Construct validity measures whether an instrument is an appropriate operational definition of an abstract concept. To assess construct validity of HOMBSAT factor analysis was performed. Factor analysis is a statistical procedure that can be useful in selecting the interrelated items which fit best into the various clusters, or "factors", representing different dimensions of a concept. Each factor is defined by those items that are more highly correlated with each other than with the other items (Carmines and Zeller, 1979). A "factor loading" is the statistical indication of how strongly related an item is with each factor. Its absolute value can range

from 0 to 1--the higher the absolute value, the more strongly related the item is. Items chosen for inclusion in a factor should correlate quite highly because they are assumed to be measuring the same dimension of a concept.

To validate the conceptualization of the dimensions of home-buyer satisfaction, and to test whether items were allocated to appropriate factors (i.e., dimensions), the principal component factoring procedure was conducted. The analysis was constrained a priori to 3 factors (design, house, and service). Next, the 3-factor solution was subjected to oblique rotation (PROMAX) to allow for intercorrelations among the dimensions and to facilitate easy interpretation.

The relationship between items and factors can be described in several different ways (Gorsuch 1983). The more important of these are the "factor structure", which shows the correlation of the items with the factors, and the "factor pattern", which shows the relationship of the factors to the items (Gorsuch 1983). We examined the factor structure matrix because it indicates the overall relationship between the item and the factor (Gorsuch 1983). The factor structure matrix for 79 items is shown in Table 6-2.

Twenty six items that have their second highest correlation within 0.10 of their highest ones were not used to define any factor. In addition, variable #19 ("How satisfied are you with outdoor privacy") was eliminated for not being completely under control of home builder, and variable #60 was eliminated because it has loading less than 0.50 on all three factors. This resulted in the final instrument consisting of 51 items--14 items representing DESIGN dimension, 16 items representing HOUSE dimension, and 21 items representing SERVICE dimension of HOMBSAT. The factor structure matrix for the final 51 items is shown in Table 6-3.

Factor analysis confirmed that almost all items loaded on the factors (dimensions) they were initially allocated to. Five items (items 22, 23, 24, 25, 26) initially allocated to the DESIGN dimension turned out to be strongly related to items belonging to HOUSE dimension. Consequently, they were reassigned to the HOUSE factor. Close look at these five items suggests that this is quite appropriate. Satisfaction with: energy-efficient features in house (item 22); utility cost (item 23); low-cost maintenance (item 24); easiness of maintenance (item 25); and with the cost and effort needed to keep the house up (item 26), indeed, seem to be influential factors in shaping one's satisfaction with a house. Table 6-4 shows the inter-factor correlations. As can be seen, the factors are moderately to highly correlated, which was expected, since they are purported to measure different dimension of same concept, namely home-buyer satisfaction.

Factor analysis was then performed on each of the factors independently. We wanted to test the dimensionality of the three factors. The Principal Component analysis was again used as extraction method, with Promax as a rotation method. This time, however, the number of factors was not a priori determined. The number of "subfactors" was determined based on the criteria that the eingenvalue for each subfactor needs to be greater than 1.0. Two subfactors having eingenvalues greater than 1.0 were found for both DESIGN and HOUSE factors, and three subfactors were found for the SERVICE factor. Structure matrixes for the three factors are shown in Table 6-5. Item allocation among different subfactors is shown in Appendix D. While it is interesting to see how each of model components can be further broken down, only overall scores on the three factors will be used for further statistical analysis. In other words, factor scores were calculated as the factors were unidimensional.

Table 6-2. Structure Matrix for HOMBSAT

Item	Component 1 Service	Component 2 Design	Component 3 House
71	.887		.620
73	.870		.665
77	.865		.645
74	.865		.688
72	.859		.627
59	.844		.537
76	.816		.627
75	.808		.580
61	.794		.502
64	.791		
57	.788		
56	.773		.511
83	.773		.647
65	.769		.508
67	.768		.539
63	.768		
66	.756		
75	.752		.671
58	.739		
77	.735		.716
76	.732		.648
62	.727		
78	.705		.681
55	.701		
54	.647		
60			
6		.799	
5		.797	
2		.780	
1		.777	
8		.751	
3		.749	
7		.746	
18		.735	
9		.695	
17		.692	.513
29		.689	.557
4		.679	
20		.675	.582
10		.672	

Item	Component 1 Service	Component 2 Design	Component 3 House
30		.666	.524
34		.633	.609
13		.605	.561
36		.588	.564
12		.576	.568
42		.548	.532
11		.516	.500
37	.587		.798
25	.539	.519	.794
46	.656		.785
47	.641		.781
26			.780
24	.555		.772
39			.742
52	.635		.728
38			.723
48	.619		.705
41	.516	.544	.692
22		.522	.691
44	.502	.573	.676
50	.589	.539	.675
33		.624	.674
32		.601	.672
15		.650	.671
40			.670
28	.506	.629	.650
49	.537		.643
35		.615	.633
51	.540		.631
14		.589	.627
53	.550		.627
23			.624
27		.604	.609
31		.574	.608
21		.530	.593
45			.585
16		.581	.584
43		.522	.581
19			.510

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Table 6-3. Structure Matrix for the Final HOMBSAT Instrument (59 items)

Item	DESIGN	HOUSE	SERVICE
6	.799		
5	.797		
2	.780		
1	.777		
8	.751		
3	.749		
7	.746		
18	.735		
9	.695		
17	.692		
29	.689		
4	.679		
10	.672		
30	.666		
37		.798	
25		.794	
46		.785	
47		.781	
26		.780	
24		.772	
39		.742	
38		.723	
41		.692	
22		.691	
44		.676	
50		.675	
40		.670	
49		.643	
23		.624	
45		.585	

Item	DESIGN	HOUSE	SERVICE
71			.887
73			.870
77			.865
74			.865
72			.859
59			.844
76			.816
75			.808
61			.794
64			.791
57			.788
56			.773
83			.773
65			.769
67			.768
63			.768
66			.756
58			.739
62			.727
55			.701
54			.647

Table 6-4. Factor Correlation Matrix

	DESIGN	HOUSE
HOUSE	0.563	1
SERVICE	0.392	0.654

Criterion Validity

Criterion validity is assessed by the degree of association between measures of related concepts. Criterion-related validity investigates the empirical relationship between

the scores on a test instrument ("predictors") and an objective measure ("the criterion") (Flynn et al. 1990). For criterion in this study we choose a subjective measure over an objective measure because of the difficulty in identifying an objective measure for home-buyer satisfaction. We used overall customer satisfaction (OVERALL) as the criterion variable. The overall satisfaction is defined as a mean of the responses to the following three questions: Considering all the things we have talked about, how satisfied are you with your house? How satisfied are you with degree to which the house has turned out to be all you expected when you bought it? and Would you recommend your home builder to one of your friends or relatives to buy a house? Each of the three questions were rated on 1 to 7 scale. The rationale for using overall satisfaction as a criterion is that overall satisfaction should represent the respondent's own weighted average of three aspects of satisfaction. Criterion validity was found to be high as measured by Pearson correlation coefficients between the three individual factor scores, their mean (SATIS) and overall satisfaction (OVERALL) (Table 6-6).

Reliability

Reliability focuses on the extent to which empirical indicators provide consistent results across repeated measurements (Carmines and Zeller 1979). A measure that is not reliable is "like an elastic tape measure; the same thing can be measured a number of times, but it will yield a different length each time" (Flynn et al. 1990, p.265). The exact reliability of empirical measurements cannot be determined (Bohrnstedt 1970); we can only obtain estimates of the reliability of an instrument. Estimates can be obtained by using one of the following four methods: the retest method, the alternative-form method,

the split-halves method, and the internal consistency method (Carmines and Zeller 1979). To estimate reliability for the three factors of HOMBSAT instrument we utilized the internal consistency method. We used this method because it requires only a single test administration, and provides a unique estimate of reliability for the given test administration. We used Cronbach Alpha coefficient as the reliability estimate. Alpha coefficient is the average of the correlation coefficients of each item with each other item making up the factor. Nunnally (1978) suggests that the minimum acceptable Alpha value is 0.70, whereas Carminas and Zeller (1979) suggest that reliability should not be below 0.80. Reliability analysis was conducted on 51 items that were retained after factor analysis. The homogeneity of the resulting items within each factor was established by computing their Alpha coefficients. All three factors demonstrated high reliability with Alpha coefficients of 0.94 for DESIGN and HOUSE factors and 0.97 for SERVICE factor.

Factor Scores

Typically, a concept is rated on several items associated with a single dimension, and the results are averaged to provide a single factor score representing one subject's reaction to one dimension of concept under investigation. The factor score serves as an index of attitudes towards particular dimension of a concept. It is reasonable to weight the items equally in calculating the factor scores by finding the simple mean of the ratings. This is in line with Nunnally's (1978) claim that that unit weights are usually preferable since unequal weights are often unstable and do not improve predictive ability significantly. Home-buyer satisfaction cannot be directly assessed. Instead it can be

indirectly inferred from scores on three factors (DESIGN, HOUSE and SERVICE) which purport to measure home-buyer satisfaction. These factor scores comprise the operational definition of the concept of home-buyer satisfaction.

Table 6-5. Structure Matrixes for DESIGN, HOUSE, and SERVICE

DESIGN			HOUSE			SERVICE			
Item	1	2	Item	1	2	Item	1	2	3
2	.864	.597	37	.847	.655	74	.929	.677	.679
5	.830	.661	39	.835	.541	73	.927	.672	.709
7	.827	.552	46	.813	.526	76	.905	.619	.623
4	.819		41	.798		77	.904	.696	.699
1	.798	.653	47	.786	.541	75	.884	.619	.644
6	.781	.756	38	.755	.583	83	.868	.605	.528
3	.768	.629	50	.742	.537	71	.866	.759	.751
17	.515	.811	40	.708	.520	72	.863	.723	.715
30		.793	44	.707	.596	65	.641	.893	.572
29	.568	.754	49	.702	.507	66	.574	.891	.609
18	.645	.738	24	.655	.902	67	.649	.840	.616
8	.671	.734	25	.706	.882	64	.681	.829	.638
10	.547	.722	26	.698	.859	63	.628	.828	.645
9	.656	.688	23		.845	62	.564	.725	.708
			22	.586	.837	57	.599	.705	.871
			45	.576	.623	58	.523	.679	.856
						59	.718	.759	.841
						56	.653	.624	.839
						54	.549	.436	.772
						61	.667	.759	.766
						55	.632	.522	.761

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Table 6-6. Correlation Coefficients Between Three Factor Scores, Their Mean, and Overall Satisfaction

	Pearson Correlations
	OVERALL
DESIGN	0.578**
HOUSE	0.754**
SERVICE	0.0777**
SATIS	0.832**

** Correlation is significant at the 0.01 level (2-tailed)

Chapter Summary

In this chapter we summarized home-buyer satisfaction survey. Data obtained from that survey were used to test reliability and validity of HOMBSAT, an instrument used for measuring home-buyer satisfaction. Based on the rigorous analysis it is concluded that the HOMBSAT instrument demonstrates high reliability and validity. We argue that HOMBSAT represents a credible instrument to measure home-buyer satisfaction, and that a solid foundation for further analysis was established. The next chapter will outline processing and analyzing of the data obtained from the two surveys. Several statistical techniques will be applied in order to gain better understanding about the relationship between Total Quality Management and home-buyer satisfaction.

CHAPTER 7
DATA ANALYSIS

Introduction

It is difficult to draw conclusions from empirical data and to generalize them, without the assistance of statistical evidence (Flynn et al. 1990). In this chapter we discuss the results from several analyses that were conducted on empirical data obtained from the survey. The data were analyzed with the aid of the SPSS computer software package. In Chapter 6 we developed and tested an instrument named HOMBSAT which makes significant progress toward achieving the first objective of this study "to establish reliable and valid measures for the assessment of home-buyer satisfaction." In the present chapter we attempt to determine the relative importance of the three dimensions of HOMBSAT and to find which areas of improvement will have the greatest impact on overall home-buyer satisfaction.

The second objective of the study is to increase understanding of the relationship between Total Quality Management (TQM) and home-buyer satisfaction. The thesis of this dissertation is that home-buyer satisfaction is determined by a company' Total Quality Management practice. In this chapter we will test that relationship and the strength of the link by applying regression analysis. Before we proceed with statistical analysis, we summarize the data obtained, followed with discussion about regression analysis and assumptions that are made in developing regression models. The main part of this chapter

deals with the statistical analysis itself. The chapter concludes with a discussion of the analysis findings and implications.

Summary of the Data

Total Quality Management Data

In order to gather data for statistical analysis we had to conduct two separate surveys. First, we conducted a survey of Total Quality Management TQM) practice employed in home building . For each of 16 participating companies data were required from five employees regarding their perception of the degree of implementation of the critical factors of TQM. This survey resulted in a data set consisting of 80 observations (16 companies x 5 respondents = 80 observations) on 71 items representing 8 critical factors of TQM. Two items were excluded from analysis for having more than 30 percent of "Not Applicable" responses, resulting in a final data set of 80 observations with 69 items. Each critical factor of TQM is represented by the following number of items: factor F1 ("Role of Divisional Top Management and Quality Policy"), 13 items (items 1-13); factor F2 ("Role of the Quality Department"), 6 items (items 14-19); factor F3 ("Training"), 10 items (items 20-29); factor F4 ("Product/Service Design"), 7 items (items 30-36); factor F5 ("Supplier Quality Management"), 10 items (items 37-46); factor F6 ("Process Management/Operating Procedures"), 6 items (items 47-53); factor F7 ("Quality Data and Reporting"), 9 items (items 54-62); and factor F8 ("Employee Relations"), 8 items (items 63-71).

Eight companies provided a negative answer to the question: Does your business unit have a separate quality department/ group/ unit? Consequently, the assessment for

Factor 2 ("Role of the Quality Department") was not provided by these companies. In order to have a balanced data set for all companies we excluded factor F2 from further analysis. This action is considered to be methodologically appropriate, since the authors of the instrument for measuring company TQM practice claim that the critical factors of TQM could be used independently or in combination (Saraph et al. 1989).

Total Quality Management Scores

For each respondent within a company, scores for 7 critical factors of TQM were determined. The factor scores were the mean of the individual's responses for the items within each factor. A mean was then obtained for each company on each of the 7 critical factors of TQM by averaging scores of 5 individuals on that factor. This resulted in a seven-dimensional vector (F1, F3, F4, F5, F6, F7, F8) which can be considered as a company TQM profile. A total company score of TQM (TOTALTQM) was then obtained by adding up the average score on each of the seven factors and then dividing by seven.

Home Buyer Satisfaction Data

The second survey was conducted on home-buyers' satisfaction. Data were collected from home buyers of participating companies regarding their level of satisfaction with design, house, and service. Home-buyer satisfaction survey resulted in a data set consisting of 273 responses on 83 items regarding home-buyers satisfaction. Four items were excluded from analysis for having more than 30 percent of "Not Applicable" responses. As a result of a factor analysis, an additional 28 items were eliminated, resulting in a final instrument consisting of 51 items; 14 items (items 1-14) representing DESIGN dimension, 16 items (items 15-30) representing HOUSE dimension, and 21

items (items 31-51) representing SERVICE dimension of home-buyer satisfaction. The number of home buyers who returned the questionnaire varied between 15 and 20 per company. In order to have a balanced data set, we retained only 15 respondents for each company for further analysis. For those companies that were represented with more than 15 respondents, responses from 15 randomly selected home buyers were retained for analysis. This process resulted in a data set with 240 observations (16 companies x 15 home buyers = 240 observations) by 51 items.

Home Buyer Satisfaction Scores

Measures of home buyers' satisfaction were obtained for each individual home buyer by calculating the home-buyer's average score on each of the three HOMBSAT dimensions. The scores were the mean of the individual's responses for the items within each dimension. The HOMBSAT scores for DESIGN, HOUSE, and SERVICE for each company were then obtained by averaging the individual home-buyer scores for that company. A total company score for home-buyer satisfaction (SATIS) was obtained by adding up the average score on each of the three dimensions and then dividing by three. Lastly, for each company the overall satisfaction score (OVERALL) was obtained as a mean of the responses for 15 home buyers to the following three questions: Considering all the things we have talked about, how satisfied are you with your house? How satisfied are you with degree to which the house has turned out to be all you expected when you bought it? and Would you recommend your home builder to one of your friends or relatives to buy a house?

Regression Analysis

In order to draw conclusions from the empirical data we employed regression analysis. In this section we discuss multiple regression analysis and assumptions used in developing a regression equation. Multiple regression is a mathematical procedure in which a regression equation, expressing the linear relationship between a criterion variable (Y) and those variables (X_1-X_k) used to predict the criterion, is obtained:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \varepsilon \qquad [7\text{-}1]$$

In this equation, the Greek letter coefficients β_0 , β_1 , β_2 ,..., β_k represent estimates of population parameters. β_i (i>0) is called a "partial slope coefficient", and represents the change in the expected value of Y associated with a one unit increase in X_i when all other independent variables in the model are held constant (Berry and Feldman 1985). β_0 is called the intercept, and represents the expected value of Y when all independent variables equal zero. ε represents the error term, where ε_i is the deviation between the observed value of Y for observation j, and the mean value of the Y distribution for cases in the population having the X values of observation j (i.e., X_1=X_{1j}, X_2=X_{2j}, ..., and X_k=X_{kj}) (Berry 1993).

There are two aspects of the linear relationship between a criterion variable and those variables used to predict the criterion. The first concerns the degree to which the predictor variables, taken together, predict the criterion variable. This degree is expressed by the coefficient of multiple determination, symbolized by "R^2". The second aspect concerns the relative importance of each of the predictor variables in accounting for the

variation in the criterion. This is expressed by the standardized regression coefficient β, termed "beta" weights. A beta weight is an estimate of how much change in the criterion variable is produced by one unit of change in a predictor variable. Thus, the greater the absolute value of the beta weights associated with a predictor variable, the better that predictor variable accounts for variations in the criterion.

Certain assumptions are made when developing a regression equation (Lewis-Beck 1980). The relationship between independent and dependent variables is assumed to be linear. It is assumed that there is no measurement error; that is, the variables X_i and Y_i are accurately measured. Next set of assumptions involves the error term. The error term is assumed to be normally distributed with zero mean. Since the distributions of Y_i and ε_i are the same (only their means are different) this assumption can be tested by analyzing the distribution of dependent variable Y. Next, the variance of the error term is assumed to be constant for all values of X_i. This assumption is known as the assumption of homoscedastic errors; when it is violated, heteroscedasticity is said to exist. The assumption of no autocorrelation means that the error corresponding to an observation is not correlated with any of the errors for the other observations. Next, the independent variables are assumed to be uncorrelated with the error term. The last assumption is the absence of perfect multicollinearity. Perfect collinearity exists when one of the independent variables in a regression equation is perfectly linearly related to one or more of the other independent variables yielding an R^2 of precisely 1.00. At that point we were ready to proceed with the statistical analysis of data.

Analysis of Home-Buyer Satisfaction Data

In this section we analyze the data obtained from home-buyer satisfaction survey. There are two goals that we want to accomplish. The first goal is to determine the relative importance of each of the three dimensions of home-buyer satisfaction. It will be accomplished by developing a regression model for overall home-buyer satisfaction (OVERALL). The second goal is to test the levels of home buyers' satisfaction with each of the three dimensions of HOMBSAT. Do the levels of satisfaction on the three dimensions of home-buyer satisfaction differ significantly? In order to answer that question, ANOVA analysis will be performed.

Multiple Regression Model for Overall Satisfaction

To determine the influence of the three dimensions of home-buyer satisfaction on home buyers' ratings of overall satisfaction, multiple regression was applied with overall satisfaction (OVERALL) as the dependent variable and the three dimensions of HOMBSAT (DESIGN, HOUSE, SERVICE) as the independent variables. The distribution of the dependent variable OVERALL is shown in Figure 7-1. The distribution is negatively skewed, though not to a worrisome degree. Regression is very robust in this regard (Tabachnick and Fidell 1983). In order to evaluate the degree of association between variables, the scatter plots of each independent variable (DESIGN, HOUSE, and SERVICE) with dependent variable (OVERALL) are made. On their face, do the independent variables seem to be correlated with the dependent? The scatter plots presented in Figure 7-2 clearly show that there is a linear relationship between the

independent variables and the dependent variable. The positive slope in all three plots is evident. We can therefore proceed with the regression analysis itself.

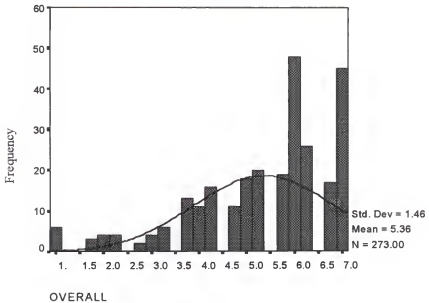


Figure 7-1. Histogram for OVERALL

A multiple-regression analysis was carried out with all 273 responses. The result of the analysis is the regression equation (Equation 7-2) presented below:

OVERALL = -1.098 + 0.504*SERVICE + 0.424*HOUSE + 0.297*DESIGN [7-2]
R^2=0.697 s_e=0.806 D-W=2.035 F=206.14 p<0.000

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed; R^2 = coefficient of multiple determination; s_e = the standard error estimate[1] of OVERALL; D-W = Durbin-Watson statistic; F = F value for the overall model; and p = value at which the model is significant.

---

[1] The standard error of the regression coefficient is a measure of the amount of variability that would be present among different β estimates from samples drawn from the same population.

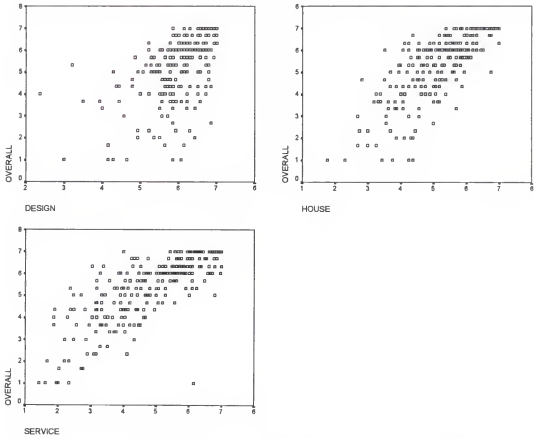


Figure 7-2. The Scatter Plots of DESIGN, HOUSE, and SERVICE with OVERALL

The overall regression model was found to be significant ($F=206.14$, $p<.000$). The R^2 was found to equal 0.697 , implying that approximately 70% of variation in the overall home-buyer satisfaction can be explained by the variability in the DESIGN, HOUSE, and SERVICE variables.

Model Evaluation

A simple and effective method for detecting model deficiencies in regression model is by examining the residuals. The residual error represents the difference between the actual value of the dependent variable and its value as estimated from the equation. In

general, when the model is correct, the standardized residuals tend to fall between 2 and –2 and are randomly distributed about zero. The standardized residuals plotted against the predicted OVERALL values are shown in Figure 7-3.

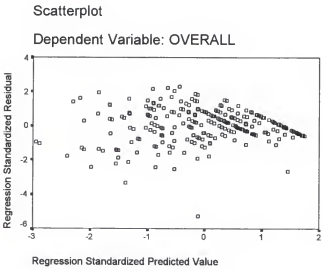


Figure 7-3. Scatterplot for OVERALL

The plot of residuals shows no distinct pattern or variation and appears to be free of abnormalities. The residuals are randomly distributed about 0, with all of them scattered within a band that extends from the line plus or minus two standard errors of estimate of OVERALL. Hence, we can conclude that the regression assumptions of normally distributed error term and homoscedascity are met. A test statistic called the Durbin-Watson coefficient can be used to test the null hypothesis that successive error terms are not autocorrelated. If the residuals for consecutive observations are uncorrelated, the expected value of the Durbin-Watson statistic is 2. Values less than 2 indicate positive autocorrelation, and values greater than 2 indicate negative autocorrelation. The Durbin-Watson statistic of 2.035 shows that autocorrelation is of no concern in this model.

Relative Importance of the Three Dimensions of HOMBSAT

Information about the relative importance of each of the three dimensions of home-buyer satisfaction can be very helpful in pinpointing areas in which to focus improvement effort in order to achieve an edge over competitors. The relative importance of each of the predictor variables in accounting for the variation in the criterion is indicated by the standardized regression coefficients, β. A standardized regression equation (Equation 7-3) for the overall satisfaction (OVERALL) is shown below. The s subscript indicates the variables are standardized.

$$OVERALL_S = 0.484*SERVICE + 0.305*HOUSE + 0.157*DESIGN \qquad [7\text{-}3]$$

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. All coefficients are positive, the expected direction of association.

One of the assumptions that a multiple regression has to meet is the absence of perfect multicollinearity. Perfect collinearity exists when one of the independent variables in a regression equation is perfectly linearly related to one or more of the other independent variables yielding an R^2 of precisely 1.00. We are usually dealing with a less extreme case of multicollinearity where the independent variables in a regression equation are intercorellated, but not perfectly. Even a high degree of multicollinearity does not violate the assumptions of regression (Berry and Feldman 1985). Beta coefficients represent the effect of one independent variable on the dependent variable with all other variables held constant. But when the independent variables in an equation are highly correlated, it is impossible to separate out the effect of one, with all others held constant, with any degree of precision (Berry and Feldman, 1985). Because of such imprecision, a

particular β estimate cannot be usefully compared to other β estimates in the regression equation, in order to arrive at a judgment of the relative effects of the independent variables (Lewis-Beck 1980). One method of dealing with multicollinearity is to regress each independent variable on all the other independent variables and to discard offending variables with the largest R^2. As a check for multicollinearity, we performed three regressions, each of which attempted to predict one independent variable from the others two. These yields the following R^2s: R^2_{DESIGN}=0.413, R^2_{HOUSE}=0.638, $R^2_{SERVICE}$=0.517. Obviously, high multicollinearity is present. We removed the HOUSE variable from the model and reestimated the standardized regression equation:

$$OVERALL_{rs} = 0.648*SERVICE + 0.277*DESIGN \qquad [7\text{-}4]$$

R^2=0.663 $\quad s_e$ =0.848 $\quad$ D-W=2.111 $\quad$ F=265.83 $\quad$ p<0.000

The regression model was highly significant, with F=265.83 (p<.000). How reliable are these new estimates? One check is to recalculate the level of mulicollinearity. Regressing SERVICE on DESIGN in the revised equation yields R^2=0.216. We conclude that this R^2 is quite far from unity, indicating that multicollinearity has ceased to be problematic. As a conservative rule-of-thumb, any R^2 below 0.50 indicates multicollinearity is of no concern.

The results of the regression analysis suggest that the SERVICE dimension has the greatest impact on the overall home-buyer satisfaction, as indicated by standardized β coefficient of 0.648. It is about two times more influential in shaping overall home-buyer satisfaction than the second most important factor, HOUSE, which has standardized β

coefficient of 0.277. The implication is that providing superior service appears to be the best strategy for builders to improve level of home-buyer satisfaction.

Industry Performance

In this section we discuss how successful home builders are in delivering the three types of home-buyer satisfaction. We want to find whether the levels of home builders' performance in delivering the three types of home-buyer satisfaction differ significantly. To accomplish that goal, ANOVA analysis of all 273 observations was performed where the actual scores on three dimensions of HOMBSAT are used as measures of success with which home builders deliver quality design, house, and service. The null hypotheses is that there is no difference among the three HOMBSAT dimensions' mean scores, i.e.,

$$\mu_{DESIGN} = \mu_{HOUSE} = \mu_{SERVICE} \qquad [7\text{-}5]$$

Based on the F-statistic ($F=85.227$, $p<0.000$), we rejected the null hypothesis; that is, the three means are not all the same. To determine specifically which dimension exhibits these differences, the Duncan method is used. The Duncan analysis shows that home buyers are the least satisfied with service ($\mu_{SERVICE} = 4.86$), slightly more satisfied with house ($\mu_{HOUSE} = 5.21$), and the most satisfied with design ($\mu_{DESIGN} = 6.05$). All differences are statistically significant at the 0.05 level.

The implication of these findings is that there is a gap between the levels of importance that design, house, and service play in shaping overall home-buyer satisfaction, and the levels of home builders' performance regarding the three types of home-buyer satisfaction. These gaps are graphically shown in Figure 7-4 below.

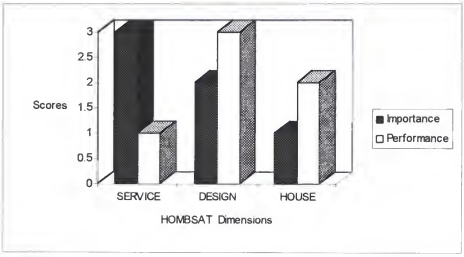


Figure 7-4. Comparison of Importance and Performance for Design, House, and Service

In constructing Figure 7-4, we assigned a significance and performance scores to each dimension of home-buyer satisfaction in accordance with the following rules: the most important factor in the regression model receives score 3, next one in importance receives score 2, and the third factor in importance receives score 1. Similarly, score 3 was assigned to the dimension with the highest mean score, score 2 to the dimension with medium mean score, and score 1 to the dimension with the lowest mean score.

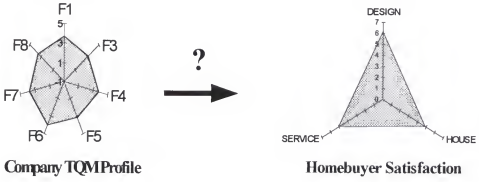
Implications

The striking finding is that the satisfaction with service is the most important component in shaping the overall home-buyer satisfaction, and at the same time, this is the area in which home builders demonstrate the poorest performance. Obviously, this is the area with greatest potential for competitive advantage and should be targeted for improvement efforts by home builders. A very encouraging finding is that home builders are already delivering quality design and to smaller extent quality houses. It seems that in

both areas home buyers' expectations are, to some extent, being met, as is indicated with relatively high mean satisfaction scores of 6.05 for design, and 5.21 for house. Satisfaction was measured on the 1-7 scale, with point 7 being labeled as "extremely satisfied."

Relationship Between Total Quality Management and Home Buyer Satisfaction

In this section we examine the link between Total Quality Management (TQM) and home-buyer satisfaction. The thesis of this dissertation is that home-buyer satisfaction is determined by a company's Total Quality Management practice. We asked the questions: How does TQM affect home-buyer satisfaction? Can home-buyer satisfaction be predicted by TQM factors? What factors of TQM are the most highly related to home-buyer satisfaction? What areas of improvement will have the greatest impact on homebuyer satisfaction? This is graphically presented in Figure 7-5.



Homebuyer Satisfaction = *f* (F1, F3, F4, F5, F5, F6, F7, F8)

Figure 7-5. What is the Relationship Between TQM and Homebuyer Satisfaction?

To find answers to previously stated questions, we conduct a number of regression analyses on the data obtained from both TQM survey and home-buyer satisfaction survey.

Combined data set consists of 16 observations, where each observation represents one company with scores on 7 critical factors of TQM (F1, F3, F4, F5, F6, F7, F8), total company TQM (TOTALTQM), 3 dimensions of HOMSAT (DESIGN, HOUSE, SERVICE), and total company home-buyer satisfaction (SATIS) (see Appendix E). After the close investigation of combined data set, one company was excluded from further analysis for having very unusual responses. That company had either the lowest or next to the lowest score among 16 companies for all of 7 critical factors of TQM, and yet received the third highest score for overall home-buyer satisfaction. One possible explanation for such an unusual data pattern is that the company was underrated with regard to current level of its TQM practice. Distribution of the TQM questionnaires was done by the contact person of the respective participating company. It was left to this person's discretion to choose four additional employees who were most familiar with the TQM practice of the company to complete the questionnaires. The five individuals that evaluated company's TQM practice may not have been a representative sample of the target population--the population made of individuals who are both knowledgeable and competent to evaluate a company TQM practice. Another possibility is that the company itself has set very high standards for performance. As a result of such an organizational culture, the self-assessment resulted in very "critical" evaluation, represented by very low scores for the seven critical factors of TQM. In addition to these other considerations, this company produces housing for a special population segment (i.e., retirement communities). Serving this special market segment may bias the relationship of company's TQM practice and home-buyer satisfaction. Whatever is the case, this company was treated as outlier and was discarded from data set, leaving 15 observations to analyze.

The rationale for excluding that observation is that it is better to exclude a possibly "good" measurement than to include a possibly "bad" one. When a "good" measurement is excluded we simply lose some of the relevant information, whereas, when a truly anomalous measurement is included it vitiates the results, biasing the final average and the estimate of precision by unknown, and generally unknowable, amounts (Natrela 1963).

Analysis

Simple and multiple regression analysis were performed on the data set, using 7 critical factors of TQM and total company TQM (TOTALTQM) as independent variables, and four measures of home-buyer satisfaction, DESIGN, HOUSE, SERVICE, and SATIS, as dependent variables. The analysis was performed in three steps as follows. We first conducted simple regression analysis where each of the four measures of home-buyer satisfaction were regressed on the total quality score (TOTALTQM). Next, for each of the four measures of home-buyer satisfaction seven simple linear regression analysis were performed with seven factors of TQM used as independent variables. In the third step, multiple regression was performed for each measure of home-buyer satisfaction for which two or more critical factors were found to be significant predictors. We now turn to presentation of the results. The discussion will be limited only to models that were found to be significant.

Dependent Variable: Total Company Home Buyer Satisfaction (SATIS)

Simple regression was applied in order to predict company home-buyer satisfaction (SATIS) using the total company TQM score (TOTALTQM) as the predictor variable. The overall regression model was found to be significant ($F=5.876$, $p<0.031$) lending preliminary support for claim that implementation of TQM is positively associated with

home-buyer satisfaction. The R^2 was found to equal 0.311, implying that 31% of variation in company home-buyer satisfaction can be explained by the variability in the dependent variable, total company TQM score. The regression model is:

SATIS = 3.882 + 0.426*TOTALTQM [7-6]
R^2=0.311 s_e=0.246 D-W=2.2 F=5.876 p<0.031

The distribution of the SATIS is shown in Figure 7-6, and the plot of standardized residuals is shown in Figure 7-7.

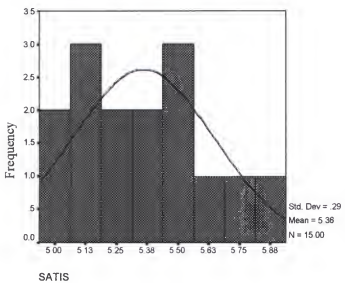


Figure 7-6. Histogram for SATIS

The distribution deviates slightly from normal, though not to a worrisome degree. Combined with the provisions of the Central Limit Theorem, we conclude that regression assumption of normally distributed dependent variable is met. The plot of residuals shows no distinct pattern or variation and appears to be free of abnormalities. Hence, we can conclude that the regression assumptions of a normally distributed error term and

homoscedasity are met. The Durbin-Watson statistic of 2.2 shows that autocorrelation is of no concern.

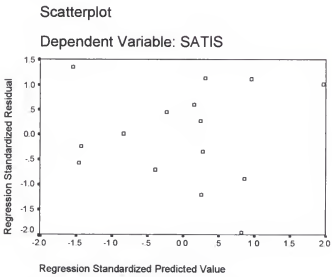


Figure 7-7. Scatterplot of standardized residuals for SATIS

Next, seven separate simple regression models were tested, where each model had company home-buyer satisfaction (SATIS) as the dependent variable, with the independent variable being one of the seven critical factor scores. Three TQM factors (F1, F4, F5) were found to be statistically significant predictors of the company home-buyer satisfaction. High scores on these three factors seem to be associated with higher company home-buyer satisfaction. The regression models are shown below:

$$SATIS = 4.238 + 0.295*F1 \quad [7\text{-}7]$$
R^2=0.236 s_e =0.2592 D-W=2.197 F=4.007 $p<0.067$

$$SATIS = 3.216 + 0.546*F4 \quad [7\text{-}8]$$
R^2=0.325 s_e =0.2436 D-W=2.259 F=6.245 $p<0.027$

$$SATIS = 3.335 + 0.608*F5 \quad [7\text{-}9]$$
R^2=0.532 s_e =0.2028 D-W=2.147 F=14.774 $p<0.002$

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. In order to determine the relative importance of each of these three factors, multiple regression was performed. We first check for multicollinearity. Three regressions were performed, each of which attempted to predict one independent variable from the other two. These yielded the following R^2s: R^2_{F1}=0.510, R^2_{F4}=0.717, R^2_{F5}=0.604. Obviously, high multicollinearity is present. We remove F4 variable from the model which resulted in the following regression equations:

$$SATIS = 3.251 + 0.067F1 + 0.555*F5 \qquad [7\text{-}10]$$

R^2=0.541 $\quad s_e$ =0.2091 $\quad$ D-W=2.138 $\quad$ F=7.058 $\quad$ p<0.009

$$SATIS_S = 0.667*F5 + 0.112F1 \qquad [7\text{-}11]$$

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. The regression model was significant, with F=7.058 (p<.009). Regressing F5 on F1 in the revised equation yields R^2_{F5}=0.314. We conclude that this R^2 is quite far from unity, indicating that multicollinearity has ceased to be problematic. The plot of residuals (Figure 7-8) shows no distinct pattern or variation and appears to be free of abnormalities. We conclude that the regression assumptions of a normally distributed error term and homoscedasity are met. The Durbin-Watson statistic of 2.138 shows that autocorrelation is of no concern. The results of the regression analysis suggest that factor F5 (Supplier Quality Management) has the greatest impact on the company home-buyer satisfaction, as indicated by standardized β coefficient of 0.667, followed by factor F1 (Role of Divisional Top management and Quality Policy), with standardized β=0.112. The implication is that

practicing factor F5 appears to be the best strategy for builders to improve level of home-buyer satisfaction.

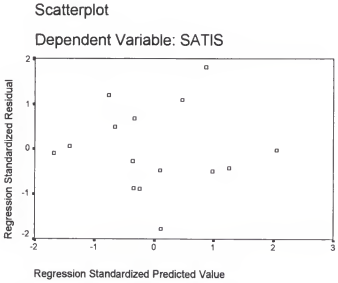


Figure 7-8. Scatterplot for SATIS

Dependent Variable: DESIGN

Simple regression was applied in order to predict satisfaction with design (DESIGN) using the total company TQM score (TOTALTQM) as the predictor variable. The overall regression model was found to be significant ($F=3.409$, $p<0.088$) lending preliminary support for claim that implementation of TQM is positively associated with home-buyer satisfaction with design. The R^2 was found to equal 0.208, implying that approximately 20% of variation in home-buyer satisfaction with design can be explained by the variability in the dependent variable, total company TQM score. The regression model is:

$$\text{DESIGN} = 5.076 + 0.278*\text{TOTALTQM} \qquad [7\text{-}12]$$

$R^2=0.208$ $\quad s_e=0.2108$ $\quad$ D-W=2.624 $\quad F=3.409$ $\quad p<0.088$

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. The distribution of the DESIGN is shown in Figure 7-9, and the plot of standardized residuals is shown in Figure 7-10.

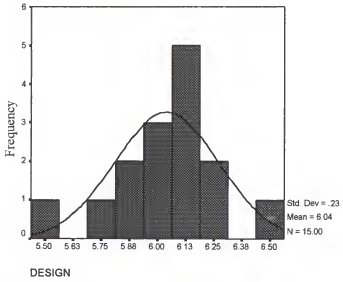


Figure 7-9. Histogram for DESIGN

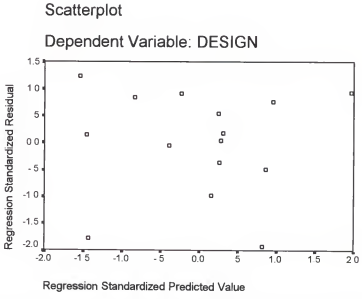


Figure 7-10. Scatterplot of standardized residuals for DESIGN

The distribution deviates slightly from normal, though not to a worrisome degree. Therefore, we conclude that regression assumption of normally distributed dependent variable is met. The plot of residuals shows no distinct pattern or variation and appears to be free of abnormalities. Hence, we can conclude that the regression assumptions of normally distributed error term and homoscedasity are met. The Durbin-Watson statistic of 2.624 shows that somewhat negative autocorrelation is present, although not to a worrisome degree.

Next, seven separate simple regression model were tested, where each model had home-buyer satisfaction with design (DESIGN) as the dependent variable, with the independent variable being one of the seven critical factor scores. Two factors (F5, F8) were found to be statistically significant predictors of the home-buyer satisfaction with design. High scores on the two factors seem to be associated with higher home-buyer satisfaction with design. The regression models are shown below:

DESIGN = 4.984 + 0.317*F5 [7-13]
R^2=0.227 s_e =0.2082 D-W=2.625 F=3.814 p<0.073

DESIGN = 5.368 + 0.206*F8 [7-14]
R^2=0.202 s_e =0.2115 D-W=2.480 F=3.299 p<0.092

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. To determine the relative importance of each of these two factors in determining home-buyer satisfaction with design, multiple regression was performed. Both regular and standardized regression equations are shown below:

DESIGN = 4.823 + 0.231F5 + 0.137F8 [7-15]
R^2=0.300 s_e =0.2062 D-W=2.687 F=2.574 p<0.117

$$DESIGN_S = 0.347F5 + 0.3F8 \qquad [7\text{-}16]$$

The regression model falls somewhat short of significance ($p<0.117$). None of β coefficients is significant at the 0.05 level, two-tailed. Regressing F5 on F8 yields $R^2_{F5}=0.186$, indicating that multicollinearity is of no concern. The plot of residuals (Figure 7-11 shows no distinct pattern or variation and appears to be free of abnormalities.

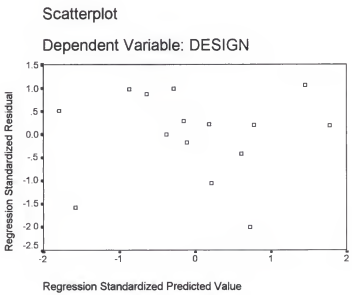


Figure 7-11. Scatterplot for DESIGN

We conclude that the regression assumptions of a normally distributed error term and homoscedasity are met. The Durbin-Watson statistic of 2.574 shows somewhat negative autocorrelation, though not to worrisome degree.

The results of the regression analysis suggest that practicing factors F5 (Supplier Quality Management) and F8 (Employee Relations) has the greatest impact on home-buyer satisfaction with design. The implication is that practicing factors F5 and F8

appears to be a good strategy for builders to improve level of home-buyer satisfaction with design.

Dependent Variable: HOUSE

Only factor F5 (Supplier Quality Management) was found to be statistically significant predictor of the home-buyer satisfaction with house. The overall regression model was found to be significant ($F=8.356$, $p<0.013$) lending preliminary support for claim that implementation of TQM is positively associated with home-buyer satisfaction with house. The R^2 was found to equal 0.391, implying that 39% of variation in home-buyer satisfaction with house can be explained by the variability in the dependent variable, factor F5 score. The regression model is:

$$HOUSE = 3.296 + 0.573*F5 \qquad [7\text{-}17]$$

$R^2=0.391$ $\quad s_e=0.2544$ $\quad$ D-W=1.600 $\quad F=8.356$ $\quad p<0.013$

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. The distribution of the DESIGN is shown in Figure 7-12, and the plot of standardized residuals is shown in Figure 7-13.

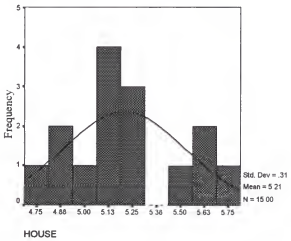


Figure 7-12. Histogram for HOUSE

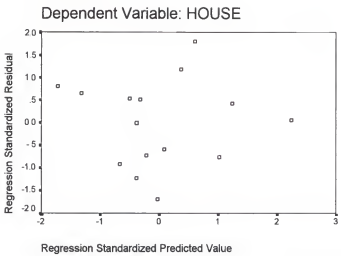


Figure 7-13. Scatterplot of Standardized Residuals for HOUSE

The distribution deviates slightly from normal, though not to a worrisome degree. We conclude that regression assumption of a normally distributed dependent variable is met. The plot of residuals shows no distinct pattern or variation and appears to be free of abnormalities. We can conclude that the regression assumptions of normally distributed error term and homoscedasity are met. The Durbin-Watson statistic of 1.600 shows that somewhat positive autocorrelation is present, though not to a worrisome degree.

Dependent Variable: SERVICE

Simple regression was applied in order to predict satisfaction with service (SERVICE) using the total company TQM score (TOTALTQM) as the predictor variable. The overall regression model was found to be significant ($F=7.936$, $p<0.015$) lending preliminary support for claim that implementation of TQM is positively associated with homebuyer satisfaction with service. The R^2 was found to equal 0.379, implying that approximately 38% of variation in home-buyer satisfaction with service can be explained

by the variability in the dependent variable, total company TQM score. The regression model is:

SERVICE = 2.342 + 0.718*TOTALTQM [7-18]
R^2=0.379 s_e =0.3568 D-W=2.225 F=7.936 p<0.015

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. The distribution of the DESIGN is shown in Figure 7-14, and the plot of standardized residuals is shown in Figure 7-15.

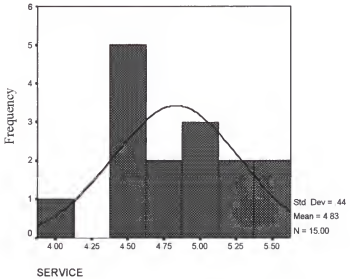


Figure 7-14. Histogram for SERVICE

The distribution deviates slightly from normal, though not to a worrisome degree. We conclude that regression assumption of a normally distributed dependent variable is met. The plot of residuals shows no distinct pattern or variation and appears to be free of abnormalities. We can conclude that the regression assumptions of normally distributed

error term and homoscedasity are met. The Durbin-Watson statistic of 2.225 shows that autocorrelation is of no concern.

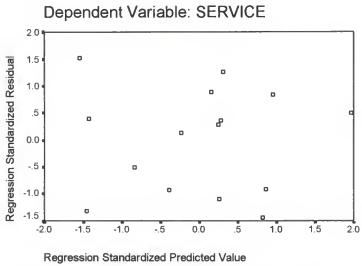


Figure 7-15. Scatterplot of Standardized Residuals for SERVICE

Next, seven separate simple regression models were tested, where each model had home-buyer satisfaction with service (SERVICE) as the dependent variable, with the independent variable being one of the seven critical factor scores. Six TQM factors (F1, F4, F5, F6, F7, F8) were found to be statistically significant predictors of the home-buyer satisfaction with service. High scores on these factors appear to be associated with higher home-buyer satisfaction with service. The regression models are shown below:

SERVICE = 3.163 + 0.439*F1 [7-19]
R^2=0.224 s_e =0.3989 D-W=2.234 F=3.748 p<0.075

SERVICE = 0.894 + 1.004*F4 [7-20]
R^2=0.470 s_e =0.3298 D-W=2.279 F=11.510 p<0.005

SERVICE = 1.725 + 0.933*F5 [7-21]
R^2=0.537 s_e =0.3081 D-W=2.167 F=15.080 p<0.002

SERVICE = 2.131 + 0.704*F6 [7-22]
R^2=0.294 s_e=0.3085 D-W=2.287 F=5.415 p<0.037

SERVICE = 3.658 + 0.370*F7 [7-23]
R^2=0.215 s_e=0.4013 D-W=2.041 F=3.550 p<0.082

SERVICE = 3.463 + 0.419*F8 [7-24]
R^2=0.230 s_e=0.3974 D-W=2.143 F=3.874 p<0.071

In order to determine the relative importance of each factor, multiple regression was performed. We first check for multicollinearity. Six regressions were performed, each of which attempted to predict one independent variable from the others five. These yielded the following R^2s: R^2_{F1}=0.676, R^2_{F4}=0.799, R^2_{F5}=0.608, R^2_{F6}=0.591, R^2_{F7}=0.833, R^2_{F8}=0.829. We removed F7 variable from the model and performed the same calculations again, this time with 5 remaining factors. This resulted in the following R^2s: R^2_{F1}=0.602, R^2_{F4}=0.783, R^2_{F5}=0.607, R^2_{F6}=0.591, R^2_{F8}=0.459. We then removed F4, repeated the same calculation which resulted in the following R^2s: R^2_{F1}=0.580, R^2_{F5}=0.399, R^2_{F6}=0.507, R^2_{F8}=0.423. We performed the calculation one more time, without factor F1. This yielded the following R^2s: R^2_{F5}=0.366, R^2_{F6}=0.421, R^2_{F8}=0.285. We conclude that multicollinearity ceased to be problematic (i.e., all R^2s are less than 0.5). Multiple regression resulted in the following equations:

SERVICE = 1.280 + 0.760*F5 + 0.142F6 + 0.145F8 [7-25]
R^2=0.577 s_e =0.3203 D-W=2.037 F=4.992 p<0.020

$SERVICE_S$ = 0.597*F5 + 0.166F8 + 0.110F6 [7-26]

The asterisk, *, indicates a coefficient statistically significant at the 0.05 level, two-tailed. The regression model was significant, with F=4.992 (p<.02). The plot of residuals (Figure 7-16) shows no distinct pattern or variation and appears to be free of abnormalities. We conclude that the regression assumptions of a normally distributed error term and

homoscedasity are met. The Durbin-Watson statistic of 2.037 shows that autocorrelation is of no concern.

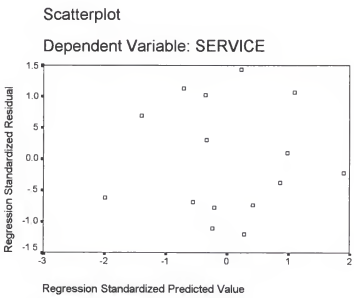


Figure 7-16. Scatterplot for SERVICE

The results of the regression analysis suggest that factor F5 (Supplier Quality Management) has the greatest impact on home-buyer satisfaction with service, as indicated by standardized β coefficient of 0.597, followed by factor F8 (Employee Relations), with standardized β=0.112, and F6 (Process Management/Operating Procedures) with β=0.110. The implication is that practicing factor F5 appears to be the best strategy for builders to improve level of home-buyer satisfaction with service.

Current Level of Industry Practice of TQM

In this section we discuss the current levels of home builders' practice of the seven critical factors of Total Quality Management. The actual scores on the factors are used as measures of the degree with which home builders practice Total Quality Management.

We want to find whether the levels of practice of critical factors differ significantly. ANOVA analysis was performed using all 80 observations obtained from TQM survey. The null hypotheses is that there is no difference in the level of practice among the seven critical factors of TQM, that is, there is no significant difference among the factors' mean scores:

$$\mu_{F1} = \mu_{F3} = \mu_{F4} = \mu_{F5} = \mu_{F6} = \mu_{F7} = \mu_{F8} \qquad [7\text{-}27]$$

Based on the F-statistic ($F=22.480$, $p<0.000$), we rejected the null hypothesis; that is, the seven means are not all the same. To determine specifically which factors exhibit these differences, the Duncan method was used. The results of the analysis are shown in Figure 7-17, below:

Mean Scores	2.90	3.11	3.22	3.30	3.73	3.74	3.86
Group 1	F3	F7					
Group 2		F7	F8	F5			
Group 3					F6	F1	F4

Figure 7-17. Duncan Comparison of Critical Factors Mean Scores

The results indicate that critical factors of TQM can be grouped into three categories with respect to current level of practice. The levels of practice between groups are significantly different at 0.05 level of significance. Home builders seem to practice least factors F3 (Training) and F7 (Quality Data and Reporting) with mean scores of $\mu_{F3}=2.90$ and $\mu_{F7}=3.11$. Slightly better performance is on factors F8 (Employee Relations), and F5 (Supplier Quality Management), which homebuilders practice more than factor F3 ($\mu_{F8}=3.22$, $\mu_{F5}=3.30$). The third group is made of factors F6 (Process Management/Operating

Procedures), F1 (Role of Divisional Top Management and Quality Policy), and F4 (Product/Service Design). These three factors appear to be most practiced by the industry with mean scores of $\mu_{F6} = 3.73$, $\mu_{F1} = 3.74$, and $\mu_{F4} = 3.86$ on the scale 1-5, where 5 represents the highest level of practice.

The implication of these findings is that there is a gap between the levels of importance that critical factors have in affecting different aspects of home-buyer satisfaction, and the levels of home builders' practice of each of the factors. These gaps are graphically shown in figures 7-18, 7-19, 7-20, and 7-21 below, where we match the importance of factors, that were found to be significant predictors for the four measures of homebuyer satisfaction, with the current level of industry performance regarding these factors.

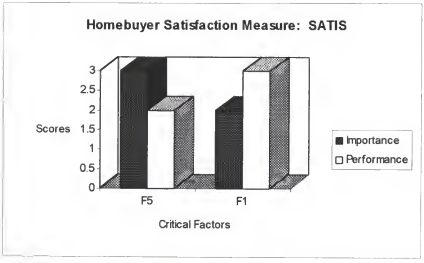


Figure 7-18. Comparison of Importance and Levels of Performance for Critical Factors of TQM for SATIS

In constructing figures 7-18, 7-19, 7-20, and 7-21 we assigned a significance and performance scores to each factor in accordance with the following rule: the most

important factor in regression model receives score 3, next one in importance receives score 2, and the third factor in importance receives score 1. Similarly, score 3 was assigned to factors that belong to group 3 (the highest practiced factors), score 2 is assigned to factors from group 2. Since none of factors from group 1 was found to be significant predictor of any measure of home-buyer satisfaction, they are not included in the graphs.

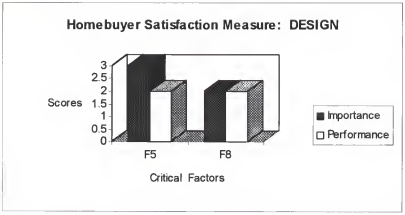


Figure 7-19. Comparison of Importance and Levels of Performance for Critical Factors of TQM for DESIGN

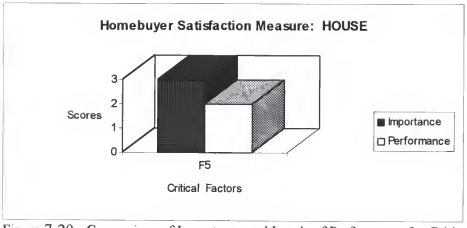


Figure 7-20. Comparison of Importance and Levels of Performance for Critical Factors of TQM for HOUSE

The implication of the results is that there is a gap between the importance that factor F5 (Supplier Quality Management) has in affecting home-buyer satisfaction, and the current level of industry practice of that factor. Since this is the area with greatest potential for competitive advantage, home builders should pay more attention and focus their improvement effort toward practicing factor F5 (Supplier Quality Management).

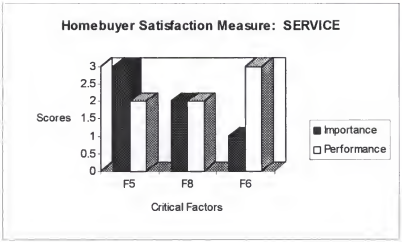


Figure 7-21. Comparison of Importance and Levels of Performance for Critical Factors of TQM for SERVICE

Implications

For the first time to our knowledge an empirical study has confirmed that implementation of Total Quality Management (TQM) by home builders is positively associated with home-buyers satisfaction. With exception of factor F3 (Training), all other factors of TQM have demonstrated lesser or greater potential for predicting four measures of home-buyer satisfaction. The matrix shown in Figure 7-22 summarizes which factor of TQM has been found to be significant predictor for which measure of home-buyer satisfaction. Factor F5 (Supplier Quality Management) has emerged as the most

important factor in shaping all three aspects of home-buyer satisfaction. It has demonstrated greater potential in predicting all four measures of home-buyer satisfaction.

	SATIS	DESIGN	HOUSE	SERVICE
F1: Role of Divisional Top Management and Quality Policy	✓			✓
F3: Training				
F4: Product/Service Design	✓			✓
F5: Supplier Quality Management	✓	✓	✓	✓
F6: Process Management/Operating Procedures				✓
F7: Quality Data and Reporting				✓
F8: Employee Relations		✓		✓
TOTALTQM: Total Company TQM	✓	✓		✓

Figure 7-22. Matrix of Associations Between Measures of Company's TQM Practice and Measures of Home-Buyer Satisfaction.

Chapter Summary

In this chapter we made significant progress toward achieving the study's objectives by finding the relative importance of each of the three dimensions of home-buyer satisfaction, and by gaining better understanding about relationship between Total Quality Management and home-buyer satisfaction. We also pinpointed areas in which to focus improvement efforts in order to achieve an edge over competitors. In the final chapter that follows, we will discuss in greater detail major findings and implications of this study. Recommendation for the future work will be also made.

CHAPTER 8
CONCLUSIONS AND RECOMMENDATIONS

The two primary objectives of this study, as stated in Chapter 1, were: (1) to establish a reliable and valid measure for the assessment of home-buyer satisfaction; and (2) to increase understanding of how Total Quality Management (TQM) affect home-buyer satisfaction. The following sections provide the reader with a summary of the results of this study and the conclusions and recommendations for future study relative to each of the two objectives.

Assessment of Home-Buyer Satisfaction

We have shown that home-buyer satisfaction can be measured. Several implications regarding home-buyer satisfaction can be drawn from the research findings. It was found that all of the three dimensions of home-buyer satisfaction (design, house, and service) are significant predictors of overall home-buyer satisfaction. This suggests that, to be most effective, home builders should have the potential of simultaneously influencing all these dimensions in a favorable way. Concentrating on, for instance, improving design quality alone may have little impact on overall home-buyer satisfaction if house and/or service quality continue to erode.

Identifying areas that demonstrate high importance in shaping overall homebuyer satisfaction is another opportunity for attaining competitive advantage. Particularly, service has emerged as the most important determinant of home-buyer overall satisfaction.

Although it would be unwise to determine far-reaching policy on just a single study, the study results suggest that the service component of a total offering deserve most attention. This result is particularly appropriate in light of another study's finding which suggests that service is the area in which home builders demonstrate the poorest performance.

Impact of Total Quality Management on Home-Buyer Satisfaction

This was an exploratory study to assess the relationship between company Total Quality Management (TQM) practice and home buyer satisfaction. The present study provides strong evidence for the influence of a company's TQM practice on home-buyer satisfaction. We have shown that home-buyer satisfaction can be successfully predicted by means of regression equation in which 31% of the variance in a company's home-buyer satisfaction (SATIS) is explained by the total company TQM score (TOTALTQM). This lends strong credence to the hypothesized relationship between Total Quality Management and homebuyer satisfaction. For the first time an empirical study has confirmed that the implementation of TQM practices is positively associated with homebuyer satisfaction. With exception of factor F3 (Training), all other critical factors of TQM have demonstrated lesser or greater potential for predicting home-buyer satisfaction. Factor F5 (Supplier Quality Management) has emerged as the most important factor in shaping all three aspects of home-buyer satisfaction (design, house, and service). The implication is that subcontractors and suppliers are critical members of building team. They have to be included in the creation of performance standards. It also suggests that home-builders should pay more attention in generating a list of approved suppliers and subcontractors. An interesting finding is that we failed to find a significant association between factor F3

(Training) and homebuyer satisfaction. One possible explanation is that training, perhaps, has not been fully implemented in home building.

The survey results provide a good snapshot of the current state of Total Quality Management practice in home building. Our survey data illustrates clear patterns where companies stress certain TQM practices but ignore others. Quality conscious product/service design (F4), management quality leadership (F1), and effective process management and operating procedures (F6) seem to be most practiced factors of TQM industrywide. Analysis of the data showed that, not only is Supplier Quality Management (F5) found to be the most strongly associated with homebuyer satisfaction, but this is also the area which home builders do not practice extensively. The level of practice of that factor is significantly lower than the level of practice for previously mentioned factors (F4, F1, and F6). The implication is that home builders should focus their improvement effort toward more practicing factor F5.

Study Contributions

By means of meeting the two research objectives, this study makes at least two specific contributions to knowledge in the field of construction management. The two contributions resulting from meeting these objectives are discussed in the following sections.

Development of the Instrument for Measuring Home-Buyer Satisfaction-HOMBSAT

We have shown that home-buyer satisfaction can be measured. Based on thorough literature search, we proposed a model that views home-buyer satisfaction as a three-dimensional satisfaction with design, house, and service. Based on that model we

developed an instrument, called HOMBSAT, that can be used to measure level of homebuyer satisfaction. We tested and concluded that the instrument demonstrates high reliability and validity. Four different measures can be calculated using data collected by the HOMBSAT, namely, score for design satisfaction (DESIGN), score for house satisfaction (HOUSE), score for service satisfaction (SERVICE), and company home-buyer satisfaction (SATIS), that can be used as performance measures for evaluation of company performance. We also created a statistical regression equation to predict overall home-buyer satisfaction (OVERALL), and the relative importance of each of the three dimensions of home-buyer satisfaction.

HOMBSAT has a variety of potential applications. First, home builders could use HOMBSAT scores to assess home-buyer satisfaction with each of the three satisfaction dimensions. It can also provide a total company home-buyer satisfaction in the form of an average score across all three dimensions. Second, using HOMBSAT scores would allow home builders to track their improvement in providing quality homes and services over the coming years. HOMBSAT is most valuable when it is used periodically to track home-buyer satisfaction trends. Third, HOMBSAT can be used by home builders to track and make comparisons among the levels of home-buyer satisfaction provided by different divisions, projects, or in different geographic locations.

Model to Predict the Impact of Total Quality Management on Home-Buyer Satisfaction

We developed several regression models to predict the impact of critical factors of Total Quality Management (TQM) on different aspects of home-buyer satisfaction. The models that link TQM with home-buyer satisfaction can help managers in pinpointing areas requiring action to improve design, house, and service quality. By identifying and

prioritizing specific areas for improvement, top management can allocate its resources efficiently, targeting those areas that are in immediate need of improvement. In summary, we argue that the proposed model can help managers better understand the relationship between all or some of the critical factors of TQM and company performance as measured by the level of home-buyer satisfaction.

Recommendations for Future Research

The initial research findings that emerged from this study are encouraging but a great deal of further research remains to be done. There are several types of future studies that would build on the results of this research.

First, the model developed in this study that links Total Quality Management (TQM) practice and home-buyer satisfaction can be extended to study how TQM influences customer satisfaction in a field other than home building. Building construction, engineering construction, and heavy and highway construction sectors of the industry can be investigated, as well.

Second, much work needs to be done with regard to linking TQM and additional operating and financial performance measures, such as net profit margin, return on investment (ROI), and employee satisfaction, to mention but a few. These alternative measures could be used in conjunction with home-buyer satisfaction to evaluate company performance, in order to give a more complete indication of the success or failure of TQM initiatives.

Third, research is recommended in order to further refine the HOMBSAT instrument and enhance its applicability across industry populations. Inclusion of

additional survey items can, perhaps, enhance the validity and reliability of the instrument. The home-buyer satisfaction model can be further expanded to include some external factors. This study only examined internal TQM factors to evaluate their impact on home-buyer satisfaction. However, many external factors might influence home-buyer satisfaction, such as income, age, level of education, and neighborhood, for example. Perhaps future research should consider the impact of these external factors on home-buyer satisfaction. These additional studies should be conducted with larger sample sizes, which will improve the power of the statistical analyses.

Conclusion

This study has resulted in new insights regarding Total Quality Management (TQM) and home-buyer satisfaction. Most of the previous research about Total Quality Management has been descriptive. This is the first study that links TQM practices with single-family detached home-buyer satisfaction. The research results found a significant relationship between TQM practice and home-buyer satisfaction in a population of medium to large Florida homebuilders. This is especially interesting in light of the recent critique of effectiveness of TQM initiatives. Our results suggest that home builders with well established TQM programs will have more success in delivering high home-buyer satisfaction; the higher level of actual practice of critical factors of TQM, the higher the home-buyer satisfaction. Supplier quality management has emerged as the most potential predictor of home-buyer satisfaction. The research also suggests that emphasizing the service component of the total offering can have far reaching positive influence on the home-buyer satisfaction. In summary, the research has made a significant contribution in

identifying the areas that can help improve company quality performance, and in turn, home-buyer satisfaction.

APPENDIX A
COMPARISON OF ITEMS PROPOSED BY SARAPH, BENSON, AND SCHROEDER (1989) WITH ITEMS USED IN PRESENT STUDY

The Critical Factors of Quality Management (Saraph, Benson and Schroeder, 1989).	**Questionnaire for the Study of Total Quality Management Practices** (Torbica, 1997).
Factor 1. Role of Divisional Top Management and Quality Policy	**Factor 1. Role of Divisional Top Management and Quality Policy**
1. Extent to which the top division executive (responsible for division profit or loss) assumes responsibility for quality performance.	1. Extent to which the top business unit executive assumes responsibility for quality performance.
2. Acceptance of responsibility for quality by major department heads within the division.	2. Extent to which major functional heads accept responsibility for quality.
3. Degree to which divisional top management (top divisional executive and major department heads) is evaluated for quality performance.	3. Extent to which business unit top management is evaluated for quality performance.
4. Extent to which the division top management supports long-term quality improvement process.	4. Extent to which the business unit top management supports long-term quality improvements.
5. Degree of participation by major department heads in the quality improvement process.	5. Extent of participation by major functional heads in the quality improvement process.
6. Extent to which the divisional top management has objectives for quality performance.	6. Extent to which the business unit top management has communicated the objectives for quality performance.
7. Specificity of quality goals within the division.	7. Extent of specificity of quality goals within the business unit.
8. Comprehensiveness of the goal-setting process for quality within the division.	8. Extent to which the goal setting process for quality within the business unit is comprehensive.
9. Extent to which quality goals and policy are understood within the division.	9. Extent to which quality goals and policy are understood throughout the business unit.
10. Importance attached to quality by the divisional top management in relation to cost and schedule objectives.	10. Extent to which the business unit top management attaches importance to quality in relation to cost and schedule objectives.

Factor 1-continued

11. Amount of review of quality issues in divisional top management meetings.

12. Degree to which the divisional top management considers quality improvement as a way to increase profits.

13. Degree of Comprehensiveness of the quality plan within the division.

Factor 1-continued

11. Extent of review of quality issues in the business unit top management meetings.

12. Extent to which the business unit top management considers quality improvement as one way to increase profits.

13. Extent of Comprehensiveness of the quality plan within the business unit.

Factor 2. Role of the Quality Department

14. Visibility of the quality department.

15. Quality department's access to divisional top management.

16. Autonomy of the quality department.

17. Utilization of quality staff professionals as a consulting resource.

18. Amount of coordination between the quality department and other departments.

19. Effectiveness of the quality department in improving quality.

Factor 2. Role of the Quality Department

14. Extent to which the quality department/ group/ unit is visible throughout the business unit.

15. Extent to which the quality department/ group/ unit has access to business unit top management.

16. Extent to which the quality department/ group/ unit is autonomous.

17. Extent to which quality staff professionals are utilized as a consulting resource.

18. Extent to which coordination exists between the quality department/ group/ unit and other functional units.

19. Extent to which the quality department/ group/ unit is effective in improving quality.

Factor 3. Training

20. Specific work-skill training (technical and vocational) given to hourly employees throughout the division.

21. Team building and group dynamics training for employees in the division.

Factor 3. Training

20. Extent to which specific work-skills training (technical and vocational) is given to non-management personnel throughout the business unit.

21. Extent of team building and group dynamics training for employees in the business unit.

Factor 3 - continued	Factor 3 - continued
22. Quality-related training given to hourly employees throughout the division.	22. Extent of quality related training for non-management employees throughout the business unit.
23. Quality-related training given to managers and supervisors throughout the division.	23. Extent to which quality related training is given to managers and supervisors throughout the business unit.
24. Training in the "total quality concept" (i.e., philosophy of company-wide responsibility for quality) throughout the division.	24. Extent of training in the "total quality concept" (company-wide responsibility for quality) throughout the business unit.
25. Training of employees to implement quality circle type program.	25. Extent of employee training to implement quality circle type programs.
26. Training in the basic statistical techniques (such as histograms and control charts) in the division as a whole.	26. Extent of training in basic statistical techniques (such as histograms, control charts, Pareto analysis, etc.) in the business unit as a whole.
27. Training in advanced statistical techniques (such as design of experiments and regression analysis) in the division as a whole.	27. Extent in training in advanced statistical techniques (such as design of experiments, regression analysis, etc.) in the business unit as a whole.
28. Commitment of the divisional top management to employee training.	28. Extent of business top management commitment to employee training.
29. Availability of resources for employee training in the division.	29. Extent to which resources are available for employee training.

Factor 4. Product/Service Design	Factor 4. Product/Service Design
30. Thoroughness of new product/service design reviews before the product/service is produced and marketed.	30. Extent of design reviews (before construction of houses starts).
31. Coordination among affected departments in the product/service development process.	**N/A**
32. Quality of new products/services emphasized in relation to cost or schedule objectives.	31. Extent of emphasis on quality of houses/ services in relation to cost or schedule objectives.
33. Extent of analysis of customer requirements in product/service development process.	32. Extent of analysis of customer requirements in house/ service development process.

Factor 4 - continued

34. Clarity of product/service specifications and procedures.

35. Extent to which implementation / producibility is considered in the product/service design process.

36. Extent to which sales and marketing people consider quality a saleable attribute.

37. Quality emphasis by sales, customer service, marketing, and PR personnel.

33. Extent to which house specifications are clearly stated.

34. Extent to which implementation/ producibility is considered in the house/ service design process.

35. Extent to which sales and marketing people consider quality a saleable attribute.

36. Extent to which quality is emphasized by supporting personnel (i.e., sales, customer service, and marketing).

Factor 5. Supplier Quality Management (Supplier of Goods and/or Services)

38. Extent to which suppliers are selected based on quality rather than price or schedule.

39. Thoroughness of the supplier rating system.

40. Reliance on reasonably few dependable suppliers.

41. Amount of education of supplier by division.

42. Technical assistance provided to the suppliers.

43. Involvement of the supplier in the product development process.

44. Extent to which longer term relationships are offered to suppliers.

45. Clarity of specifications provided to suppliers.

46. Responsibility assumed by purchasing department for the quality of incoming products/services.

Factor 5. Supplier Quality Management (Supplier of Goods and/or Services)

37. Extent to which subcontractors / suppliers are selected based on their quality of workmanship.

38. Extent of the thoroughness of the subcontractor / supplier rating system.

39. Extent of reliance on only a few dependable subcontractors / suppliers.

40. Extent of education of subcontractors / suppliers by the business unit.

41. Extent of technical assistance provided to subcontractors / suppliers.

42. Extent of subcontractor/supplier involvement in the house design process.

43. Extent to which long term relationships are offered to subcontractors / suppliers.

44. Extent to which specifications (requirements) provided to subcontractors / suppliers are clearly stated.

45. Extent to which responsibility for the quality of incoming products/services is assumed by the purchasing department/ group/ unit.

Factor 5 - continued	**Factor 5 - continued**
47. Extent to which suppliers have programs to assure quality of their products/services.	46. Extent to which subcontractors / suppliers have programs to assure quality of incoming products/ services.
Factor 6. Process Management/ Operating Procedures	**Factor 6. Process Management/ Operating Procedures**
48. Use of acceptance sampling to accept/reject lots or batches of work.	**N/A**
49. Use of statistical control charts to control processes.	47. Extent to which statistical control charts are used to control processes.
50. Amount of preventive equipment maintenance.	48*. Extent of preventive equipment maintenance.
51. Extent to which inspection, review, or checking of work is automated.	**N/A**
52. Amount of incoming inspection, review, or checking.	**N/A**
53. Amount of in-process inspection, review, or checking.	49. Extent of in-process inspection, review or checking during construction phase.
54. Amount of final inspection, review, or checking of work.	50. Extent of final house inspection.
55. Importance of inspection, review, or checking of work.	51. Extent to which inspection, review or checking is considered important.
56. Self-inspection of work by workers.	52. Extent of self-inspection of work by workers.
57. Stability of production schedule/work distribution.	**N/A**
58. Degree of automation of the process.	**N/A**
59. Extent to which process design is "fool-proof" and minimizes the chances of employee errors.	**N/A**
60. Clarity of work or process instructions given to employees.	53. Extent to which work or process instructions are clear.

Factor 7. Quality Data and Reporting

61. Availability of cost of quality data in the division.

62. Availability of quality data (error rates, defect rates, scrap, defects, etc.)

63. Timeliness of the quality data.

64. Extent to which quality data collected by the service/support areas of the division.

65. Extent to which quality data (cost of quality, defects, errors, scrap, etc.) are used as tools to manage quality.

66. Extent to which quality data are available to hourly employees.

67. Extent to which quality data are available to managers and supervisors.

68. Extent to which quality data are used to evaluate supervisor and managerial performance.

69. Extent to which quality data, control charts, etc., are displayed at employee work stations.

Factor 7. Quality Data and Reporting

54. Extent to which cost of quality information is available in the business unit.

55. Extent of availability of quality data (such as error rates, defect rates, scrap, etc.).

56. Extent to which quality data are timely.

57. Extent of quality data collected by the service areas of the business unit.

58. Extent to which quality data (cost of quality, defects, scrap, etc.) are used as tools to manage quality.

59. Extent to which quality data are available to non-management workers.

60. Extent to which quality data are available to management and supervisors.

61. Extent to which quality data are used to evaluate supervisor and managerial performance.

62. Extent to which quality data, control charts, etc. are displayed at employee work stations.

Factor 8. Employee Relations

70. Extent to which quality circle or employee involvement type programs are implemented in the division.

71. Effectiveness of quality circle or employee involvement type programs in the division.

72. Extent to which employees are held responsible for error-free output.

73. Amount of feedback provided to employees on their quality performance.

74. Degree of participation in quality decisions by hourly/nonsupervisory employees.

Factor 8. Employee Relations

63. Extent to which employee involvement programs (such as quality circles) are implemented in the business unit.

64. Extent of effectiveness of employee involvement programs in the business unit.

65. Extent to which the employees are held responsible for error free output.

66. Extent of feedback provided to the employees on their quality performance.

67. Extent of participation in quality decisions by non-management employees.

Factor 8 - continued	Factor 8 - continued
75. Extent to which quality awareness building among employees is ongoing.	68. Extent to which quality awareness building among employees is on-going.
76. Extent to which employees are recognized for superior quality performance.	69. Extent to which employees are recognized for superior quality performance.
77. Impact of labor union quality improvement.	70*. Extent to which a labor union impacts quality improvement.
78. Effectiveness of supervisors in solving problems/issues.	71. Extent of supervisor effectiveness in handling quality decision/problems/issues.

Asterisk, *, indicates items that were eliminated for having more than 30 percent of "Not Applicable" responses.

APPENDIX B
HOME-BUYER SATISFACTION SURVEY PACKAGE

Cover Letter Used In Home-Buyer Satisfaction Survey

Dear Mr. Smith:

We are requesting your assistance in a study on home buyers' satisfaction with their new homes and with the services received. The study is being conducted by the M.E.Rinker, Sr., School of Building Construction at University of Florida. The focus of this study is to assess how well the residential home building industry is meeting home buyers' expectations. This is the first study of this type that has ever been done.

You were randomly selected from those who have recently purchased a new house. In order to measure satisfaction with your house and the services received from the home builder, we are providing you with a copy of a questionnaire. It should take you about 20 minutes to complete the questionnaire, and you need only check off your answers or jot down a number.

You can be absolutely sure that all of the information you provide is **strictly confidential**, and no individual names will be identified. Your answers will be combined with those of many others and used only for the purpose of statistical analysis.

In order that the results of the study will be truly representative of the experience of recent home buyers, it is extremely important that each survey question be answered and the questionnaire be returned to the University. If possible, please return your questionnaire within 7 days in the stamped, addressed envelope provided.

Your honest impressions and opinions are very necessary to be sure that the home building industry serves the public as effectively as possible. When our research is completed, we hope to make the results known to you through research reports, articles and other publications. We will be happy to send you a copy of the results if you desire one. Simply put your name and address in the space provided at the end of the questionnaire. We expect to have the results ready to send sometime during late summer.

Thank you very much for your time and cooperation. Your contribution to the success of this study will be appreciated greatly. If you have any comments or questions, please feel free to contact me at: (352) 392-7697 (University) / (352) 846-5413 (home), or Dr. Robert Stroh at: (352) 392-7697 (University).

Sincerely,

Zeljko M. Torbica

Enclosures

Follow-up Letters for Home-Buyer Satisfaction Survey

First Follow-up Letter for Home-Buyer Satisfaction Survey

Dear Mr. Adams:

A couple days ago we sent you a questionnaire as part of the study on home buyers' satisfaction with their new homes and with the services received.

If you have already completed and returned it to us please consider this a special "thank you" for your promptness. If not, please do so today. Because it has been sent to only a small, but representative, sample of those who have recently purchased a new house it is extremely important that yours also be included in the study if the results are to represent accurately the experiences of recent home buyers.

Your contribution to the success of this study will be appreciated greatly.

Sincerely,

Zeljko M. Torbica

Second Follow-up Letter for Home-Buyer Satisfaction Survey

Dear Mrs. Johns:

About three weeks ago we sent you a questionnaire as part of our study on home buyers' satisfaction with their new homes and the services received. As of today we have not yet received your completed survey. In order for the results of this study to be truly representative of the experience of recent home buyers, it is important that each person return the questionnaire. In the event that your questionnaire has been misplaced we are forwarding a replacement, and we would ask you to complete the same and return in the enclosed, self-addressed, envelope.

Your cooperation is greatly appreciated.

Cordially,

Zeljko M. Torbica

Questionnaire For The Study Of New-Home Buyer Satisfaction

Questionnaire For The Study Of New-Home Buyer Satisfaction

Congratulations on your new home purchase!

You are asked to evaluate satisfaction with your new home and the services provided by your home builder. Please respond only to those questions that are applicable to you.

PART ONE: QUESTIONS PERTAINING TO HOME PURCHASE PROCESS

Please provide the following information regarding your home purchase experience. Indicate your answers by marking the appropriate box.

1. *Was your house design determined by your home builder?* Yes ☐ No ☐ Don't Know ☐

2. *If Yes, had you selected a house in which you:*

(a) had no choice in the plan, materials, and construction ☐
(b) had chosen a plan and built the house exactly to specifications ☐
(c) had selected and modified a plan before construction began. ☐

3. *How do you describe your present situation?*

(a) first time home owner ☐
(b) second time home owner ☐
(c) have owned more than two personal homes over the years ☐

4. *How did you locate your present home?*

(a) through real estate agent ☐
(b) directly from housing contractor/builder ☐
(c) other (specify) ☐ _____

5. *About how long had you looked for the house?*

(a) less than 1 month ☐ (b) 1-3 months ☐ (c) 3-6 months ☐ (d) more than 6 months ☐
(e) Not Applicable ☐

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

6. *About how many houses did you look at before signing a contract?*

(a) 1-5 ☐ (b) 6-10 ☐ (c) 11-15 ☐ (d) 16-20 ☐ (e) more than 20 ☐ (f) Not Applicable ☐

PART TWO: QUESTIONS PERTAINING TO THE HOUSE UNIT

Please provide the following information regarding your house unit.

1. *Floor area of your house (conditioned) is:*

(a) less than 1,300 sq.ft. ☐ (b) 1,301-1,500 sq.ft. ☐ (c) 1,501-1,700 sq.ft. ☐

(d) 1,701-1,900 sq.ft. ☐ (e) 1,901-2,100 sq.ft. ☐ (f) 2,101-2,300 sq.ft. ☐

(g) more than 2,300 sq.ft ☐

2. *How much did you pay for your house?*

(a) under $50,000 ☐ (b) $50,001-70,000 ☐ (c) $70,001-90,000 ☐ (d) $90,001-110,000 ☐

(e) $110,001-130,000 ☐ (f) $130,001-150,000 ☐ (g) over $150,000 ☐

3. *Present housing construction is:*

(a) wood frame ☐ (b) brick ☐ (c) stone ☐ (d) blocks ☐ (e) combination of ___ and ___ above.

4. *How would you describe your present home?*

(a) 2 story ☐ (b) 1 1/2 story ☐ (c) 1 story ☐ (d) other (specify) ☐ _____

5. *When was your home completed and ready for move-in?*

(a) Built before purchase ☐ (b) Earlier than anticipated or on time ☐ (c) 0-2 weeks late ☐
(d) 2-4 weeks late ☐ (e) 1-2 months late ☐ (g) over 2 months late ☐

6. *When did you move into your house?*

(a) August '95 ☐ (b) September '95 ☐ (c) Other (specify) ☐ _____

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

PART THREE: QUESTIONS PERTAINING TO HOME BUYER SATISFACTION

1. Satisfaction With The House

Please describe your satisfaction with each issue by circling ONE number for each question. If the question does not apply, mark the N/A ("Not Applicable").

NOTE: **1**=Very Dissatisfied (**VD**), **2**=Dissatisfied (**D**), **3**=Somewhat Dissatisfied (**SD**), **4**=Neither Dissatisfied Nor Satisfied (**N**), **5**=Somewhat Satisfied (**SS**), **6**=Satisfied (**S**), 7=Very Satisfied (**VS**)

Not Appl N/A			Very Dissatis. VD	D	SD	N	SS	S	Very Satisfied VS
☐	1.	How satisfied are you with your house floor plan?	1	2	3	4	5	6	7
☐	2.	How satisfied are you with the scale and proportion of floor plan?	1	2	3	4	5	6	7
☐	3.	How satisfied are you with the number of rooms in your house?	1	2	3	4	5	6	7
☐	4.	How satisfied are you with the size of the rooms in your house?	1	2	3	4	5	6	7
☐	5.	How satisfied are you with the layout of the rooms, that is, the design in relation to your daily life?	1	2	3	4	5	6	7
☐	6.	How satisfied are you with the location of the different rooms?	1	2	3	4	5	6	7
☐	7.	How satisfied are you with individual space for each member of your household?	1	2	3	4	5	6	7
☐	8.	How satisfied are you with your kitchen design?	1	2	3	4	5	6	7
☐	9.	How satisfied are you with bathroom(s) design?	1	2	3	4	5	6	7
☐	10.	How satisfied are you with the number of bathrooms in your dwelling unit?	1	2	3	4	5	6	7
☐	11.	How satisfied are you with the amount of storage space in your house?	1	2	3	4	5	6	7
☐	12.	How satisfied are you with the kind of storage space in your house?	1	2	3	4	5	6	7
☐	13.	How satisfied are you with location and distribution of storage?	1	2	3	4	5	6	7

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

NOTE: **1**=Very Dissatisfied (VD), **2**=Dissatisfied (D), **3**=Somewhat Dissatisfied (SD), **4**=Neither Dissatisfied Nor Satisfied (N), **5**=Somewhat Satisfied (SS), **6**=Satisfied (S), **7**=Very Satisfied (VS)

Not Appl N/A			Very Dissatis. VD	D	SD	N	SS	S	Very Satisfied VS
☐	14.	How satisfied are you with esthetic quality of the interior?	1	2	3	4	5	6	7
☐	15.	How satisfied are you with the inside of your home?	1	2	3	4	5	6	7
☐	16.	How satisfied are you with color(s) of the rooms?	1	2	3	4	5	6	7
☐	17.	How satisfied are you with ceiling height?	1	2	3	4	5	6	7
☐	18.	How satisfied are you with the amount of privacy available in your house?	1	2	3	4	5	6	7
☐	19.	How satisfied are you with outdoor privacy?	1	2	3	4	5	6	7
☐	20.	How satisfied are you with the safety (accident potential) in your home?	1	2	3	4	5	6	7
☐	21.	How satisfied are you with the security in your house?	1	2	3	4	5	6	7
☐	22.	How satisfied are you with the energy-efficient features in your house?	1	2	3	4	5	6	7
☐	23.	How satisfied are you with utility cost?	1	2	3	4	5	6	7
☐	24.	How satisfied are you with low-cost maintenance features in your house?	1	2	3	4	5	6	7
☐	26.	How satisfied are you with easiness of maintenance of your house?	1	2	3	4	5	6	7
☐	26.	How satisfied are you with the cost and effort needed to keep the house up?	1	2	3	4	5	6	7
☐	27.	How satisfied are you with illumination level or quantity of light in your house?	1	2	3	4	5	6	7
☐	28.	How satisfied are you with the electric lighting in your house?	1	2	3	4	5	6	7
☐	29.	How satisfied are you with the number and placement of electrical outlets?	1	2	3	4	5	6	7

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

NOTE: **1**=Very Dissatisfied (**VD**), **2**=Dissatisfied (**D**), **3**=Somewhat Dissatisfied (**SD**), **4**=Neither Dissatisfied Nor Satisfied (**N**), **5**=Somewhat Satisfied (**SS**), **6**=Satisfied (**S**), **7**=Very Satisfied (**VS**)

Not Appl N/A			Very Dissatis. VD	D	SD	N	SS	S	Very Satisfied VS
☐	30.	How satisfied are you with the brightness or light in your house during the daytime?	1	2	3	4	5	6	7
☐	31.	How satisfied are you with protection from neighborhood noise?	1	2	3	4	5	6	7
☐	32.	How satisfied are you with the soundproof performance of walls?	1	2	3	4	5	6	7
☐	33.	How satisfied are you with the outside appearance of your house?	1	2	3	4	5	6	7
☐	34.	How satisfied are you with how the architectural style of your house is in harmony with landscape?	1	2	3	4	5	6	7
☐	35.	How satisfied are you with how your house fits the environment?	1	2	3	4	5	6	7
☐	36.	How satisfied are you with attractiveness of house color?	1	2	3	4	5	6	7
☐	37.	How satisfied are you with the quality of building materials used in your house?	1	2	3	4	5	6	7
☐	38.	How satisfied are you with the quality of materials used in floors?	1	2	3	4	5	6	7
☐	39.	How satisfied are you with the quality of materials used in walls?	1	2	3	4	5	6	7
☐	40.	How satisfied are you with the operation of windows?	1	2	3	4	5	6	7
☐	41.	How satisfied are you with the operation of doors?	1	2	3	4	5	6	7
☐	42.	How satisfied are you with the operation of kitchen appliances?	1	2	3	4	5	6	7
☐	43.	How satisfied are you with the operation of plumbing fixtures?	1	2	3	4	5	6	7

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

NOTE: **1**=Very Dissatisfied (**VD**), **2**=Dissatisfied (**D**), 3=Somewhat Dissatisfied (**SD**), **4**=Neither Dissatisfied Nor Satisfied (**N**), **5**=Somewhat Satisfied (**SS**), **6**=Satisfied (**S**), **7**=Very Satisfied (**VS**)

Not Appl N/A			Very Dissatis. VD	D	SD	N	SS	S	Very Satisfied VS
☐	44.	How satisfied are you with the operation of electrical features?	1	2	3	4	5	6	7
☐	45.	How satisfied are you with the operation of Heating/Air Conditioning?	1	2	3	4	5	6	7
☐	46.	How satisfied were you with quality of finish workmanship?	1	2	3	4	5	6	7
☐	47.	How satisfied are you with the quality of workmanship of painting (free of nail pops, free of shrinkage cracks, etc)?	1	2	3	4	5	6	7
☐	48.	How satisfied are you with the quality of workmanship of cabinets (free of damage, doors operate properly, hardware installed)?	1	2	3	4	5	6	7
☐	49.	How satisfied are you with the roof performance?	1	2	3	4	5	6	7
☐	50.	How satisfied are you with the performance of foundation?	1	2	3	4	5	6	7
☐	51.	How satisfied are you with the quality of landscaping?	1	2	3	4	5	6	7
☐	52.	How satisfied were you with the completion of home at move-in?	1	2	3	4	5	6	7
☐	53.	How satisfied were you with the cleanliness of home at move-in?	1	2	3	4	5	6	7

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

2. Service Quality

For each statement in the following section, please circle the appropriate response on the 7-point scale. Mark the N/A ("Not Applicable") if you feel it is not applicable or you can not evaluate.

NOTE: 1=Very Low (**VL**), 2=Low (**L**), 3=Somewhat Low (**SL**), 4=Moderate (**M**), 5=Somewhat High (**SH**), 6=High (**H**), 7=Very High (**VH**)

Not Appl N/A			Very Low VL	L	SL	M	SH	H	Very High VH
☐	54.	Extent to which home builder set your expectations early.	1	2	3	4	5	6	7
☐	55.	Extent to which home builder personnel were available during evening and weekend hours.	1	2	3	4	5	6	7
☐	56.	Extent to which you were welcomed enthusiastically.	1	2	3	4	5	6	7
☐	57.	Extent to which home builder presented the basic advantages of their home.	1	2	3	4	5	6	7
☐	58.	Extent to which home builder pointed out some hidden values of the home.	1	2	3	4	5	6	7
☐	59.	Extent to which you were treated like a person, not a number.	1	2	3	4	5	6	7
☐	60.	Extent to which home builder personnel acted too pushy - used too much pressure.	1	2	3	4	5	6	7
☐	61.	Extent to which home builder personnel showed interest in you as a customer.	1	2	3	4	5	6	7
☐	62.	Extent to which you were given a quiet place to make decisions.	1	2	3	4	5	6	7
☐	63.	Extent to which home builder explained every step of home buying and building process to you.	1	2	3	4	5	6	7
☐	64.	Extent to which it was made clear to you whom you should contact during construction.	1	2	3	4	5	6	7
☐	65.	Extent to which home builder explained to you warranty coverage.	1	2	3	4	5	6	7
☐	66.	Extent to which home builder explained to you your responsibilities for maintenance and upkeep.	1	2	3	4	5	6	7

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

NOTE: 1=Very Low (**VL**), 2=Low (**L**), 3=Somewhat Low (**SL**), 4=Moderate (**M**), 5=Somewhat High (**SH**), 6=High (**H**), 7=Very High (**VH**)

Not Appl N/A		Very Low VL	L	SL	M	SH	H	Very High VH
☐	67. Extent to which home builder explained to you the way the various items in your home operate.	1	2	3	4	5	6	7
☐	68. Extent to which your builder clearly explained financing options and the loan process.	1	2	3	4	5	6	7
☐	69. Extent to which your builder kept you informed about approval and rate changes.	1	2	3	4	5	6	7
☐	70. Extent to which your builder made best effort to get loan approved.	1	2	3	4	5	6	7

Please describe your satisfaction with each issue in the following section by circling the appropriate response on the 7-point scale. Mark the N/A ("Not Applicable") if you feel it is not applicable or you can not evaluate.

NOTE: **1**=Very Dissatisfied (**VD**), **2**=Dissatisfied (**D**), **3**=Somewhat Dissatisfied (**SD**), 4=Neither Dissatisfied Nor Satisfied (**N**), **5**=Somewhat Satisfied (**SS**), **6**=Satisfied (**S**), 7=Very Satisfied (**VS**)

Not Appl N/A		Very Dissatis. VD	D	SD	N	SS	S	Very Satisfied VS
☐	71. How satisfied were you with professionalism of home builder personnel?	1	2	3	4	5	6	7
☐	72. How satisfied were you with competence (skills and knowledge) of home builder personnel?	1	2	3	4	5	6	7
☐	73. How satisfied were you with responsiveness (willingness to help and provide prompt service) of home builder personnel?	1	2	3	4	5	6	7
☐	74. How satisfied were you with reliability (ability to perform the promised service dependably and accurately) of home builder personnel?	1	2	3	4	5	6	7
☐	75. How satisfied were you with courteousness of home builder personnel?	1	2	3	4	5	6	7
☐	76. How satisfied were you with communication with builder's construction personnel?	1	2	3	4	5	6	7

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

NOTE: **1**=Very Dissatisfied (VD), **2**=Dissatisfied (D), **3**=Somewhat Dissatisfied (SD), **4**=Neither Dissatisfied Nor Satisfied (N), **5**=Somewhat Satisfied (SS), **6**=Satisfied (S), **7**=Very Satisfied (VS)

Not Appl N/A			Very Dissatis. VD	D	SD	N	SS	S	Very Satisfied VS
☐	77.	How satisfied were you with builder's responsiveness to questions/ concerns?	1	2	3	4	5	6	7
☐	78.	How satisfied were you with financing alternatives suggested by your builder?	1	2	3	4	5	6	7
☐	79.	How satisfied were you with the time taken by your builder to repair items identified on your walk-through list?	1	2	3	4	5	6	7
☐	80.	How satisfied were you with the time taken by your builder to respond to your request for repair?	1	2	3	4	5	6	7
☐	81.	How satisfied were you with quality of repairs made since move-in?	1	2	3	4	5	6	7
☐	82.	How satisfied were you with clean-up by repair personnel after completing repairs?	1	2	3	4	5	6	7
☐	83.	How would you rate your satisfaction with your builder's attitude about customer service (i.e. after move-in)?	1	2	3	4	5	6	7
☐	S1	Considering all the things we have talked about, how satisfied are you with your house?	1	2	3	4	5	6	7
☐	S2	How satisfied are you with degree to which the house has turned out to be all you expected when you bought it?	1	2	3	4	5	6	7
☐	S3	How satisfied are you with price for quality offered?	1	2	3	4	5	6	7
			Definitely Would NOT						**Definitely Would**
☐	S4	Would you recommend your home builder to one of your friends or relatives wanting to buy a house?	1	2	3	4	5	6	7

This is the end of the questionnaire.

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

Please return your completed survey in the stamped, addressed envelope at the following address:

Zeljko M. Torbica
M.E.Rinker, Sr., School of Building Construction
FAC 101, University of Florida
P.O.Box 115703
Gainesville, FL 32611-5703

If you want a copy of the survey results, please include the following information:

Your name: _____

Address: _____

City: _____

State/Zip: _____

Telephone: _____

Thank you for your time and cooperation!

If you have any questions, please call Zeljko (Marko) Torbica at (352) 392-7697 (University) / (352) 846-5413 (home), or Dr. Robert Stroh at (352) 392-7697 (University).

Gender: ☐ M ☐ F

What is your age? _____

Date: _____ / _____ / 1996

THANK YOU!

ALL INFORMATION PROVIDED WILL BE KEPT STRICTLY CONFIDENTIAL!

APPENDIX C
COVER LETTER USED IN TOTAL QUALITY MANAGEMENT SURVEY

Dear Ms. McMullen:

We are requesting your assistance in a study on Total Quality Management (TQM) in the home building industry. The study is being conducted by the M.E.Rinker, Sr., School of Building Construction at University of Florida. The focus of this study is to assess how TQM affects company performance. We are particularly interested in understanding the importance of different aspects of TQM in relation to homebuyers' satisfaction. This is the first study of this type that has ever done.

The study will be conducted in two phases. In the Phase One, that you are part of, a select group of large residential home builders in Florida will evaluate their Total Quality Management practice by using the questionnaire provided. Part One of the questionnaire needs to be filled out by five different employees who have experience and knowledge about your business unit quality performance. Depending on how your company is organized, your business unit may be the entire company, a division, or a branch. Part Two of the questionnaire deals with general information and some financial and operating performance measures for your business unit. We need only one employee to fill out the Part Two.

In Phase Two of this study we will measure homebuyers' satisfaction with their new homes and with the services received. Every participating company (i.e., business unit) will be represented by a randomly selected sample from its recent Florida homebuyer population. Our study is focused on homebuyers who purchased and moved into their homes during the period August 1 through September 30, 1995. In order to have a small, but representative, sample it is extremely important for us to have a complete list (names, addresses, and phones) of your single-family detached homebuyers for that period. Once again, we are asking you for help - your assistance in providing this list will be very much appreciated. If your business unit sales for the month August 1995 exceeds 40 single family detached units, we ask you for the list for that month only.

You can be absolutely sure that all of the information you provide is **strictly confidential**, and no company or individual names will be identified. Data obtained from you will be combined with that of other companies and used only for statistical analysis.

We genuinely appreciate your valuable assistance. As a way of showing our appreciation, we will be happy to send you a summary report of the findings. Also, we will provide you with detailed evaluation of your company performance with respect to different aspects of Total Quality Management, as well as an assessment of where you stand in comparison to your competition. Most importantly, you will benefit from this study in that it will help you focus your quality effort on areas that will have the greatest impact on homebuyers' satisfaction. We expect to have the results ready to send sometime during late summer.

Please help us understand more about the impact of Total Quality Management on homebuyers' satisfaction. This survey should take about 25 minutes to complete. If possible, please return the whole package (five copies of questionnaire, and the list of your recent single-family detached homebuyers) within 7 days in the stamped, addressed envelope provided.

Thank you very much for your time and cooperation. If you have any comments or questions, please feel free to contact me at: (352) 392-7697 (University) / (352) 846-5413 (home), or Dr. Robert Stroh at (352) 392-7697 (University).

Sincerely,

Zeljko M. Torbica

Enclosures

APPENDIX D
HOMBSAT INSTRUMENT

	Sub-Factor	Sub-Factor	Item	DESIGN
1	D1		1	How satisfied are you with your house floor plan?
2	D1		2	How satisfied are you with the scale and proportion of floor plan?
3	D1		3	How satisfied are you with the number of rooms in your house?
4	D1		4	How satisfied are you with the size of the rooms in your house?
5	D1		5	How satisfied are you with the layout of the rooms, that is, the design in relation to your daily life?
6	D1		6	How satisfied are you with the location of the different rooms?
7	D1		7	How satisfied are you with individual space for each member of your household?
8		D2	8	How satisfied are you with your kitchen design?
9		D2	9	How satisfied are you with bathroom(s) design?
10		D2	10	How satisfied are you with the number of bathrooms in your dwelling unit?
11		D2	17	How satisfied are you with ceiling height?
12		D2	18	How satisfied are you with the amount of privacy available in your house?
13		D2	29	How satisfied are you with the number and placement of electrical outlets?
14		D2	30	How satisfied are you with the brightness or light in your house during the daytime?

	Sub-Factor	Sub-Factor	Item	HOUSE
15	H1		22	How satisfied are you with the energy-efficient features in your house?
16	H1		23	How satisfied are you with utility cost?
17	H1		24	How satisfied are you with low-cost maintenance features in your house?
18	H1		25	How satisfied are you with easiness of maintenance of your house?
19	H1		26	How satisfied are you with the cost and effort needed to keep the house up?
20	H1		45	How satisfied are you with the operation of Heating/Air Conditioning?
21		H2	37	How satisfied are you with the quality of building materials used in your house?
22		H2	38	How satisfied are you with the quality of materials used in floors?
23		H2	39	How satisfied are you with the quality of materials used in walls?
24		H2	40	How satisfied are you with the operation of windows?
25		H2	41	How satisfied are you with the operation of doors?
26		H2	44	How satisfied are you with the operation of electrical features?
27		H2	46	How satisfied were you with quality of finish workmanship?
28		H2	47	How satisfied are you with the quality of workmanship of painting (free of nail pops, free of shrinkage cracks, etc)?
29		H2	49	How satisfied are you with the roof performance?
30		H2	50	How satisfied are you with the performance of foundation?

	Sub-Fac.	Sub-Fac.	Sub-Fac.	Item	SERVICE
31	S1			54	Extent to which home builder set your expectations early.
32	S1			55	Extent to which home builder personnel were available during evening and weekend hours.
33	S1			56	Extent to which you were welcomed enthusiastically.
34	S1			57	Extent to which home builder presented the basic advantages of their home.
35	S1			58	Extent to which home builder pointed out some hidden values of the home.
36	S1			59	Extent to which you were treated like a person, not a number.
37	S1			61	Extent to which home builder personnel showed interest in you as a customer.
38		S2		62	Extent to which you were given a quiet place to make decisions.
39		S2		63	Extent to which home builder explained every step of home buying and building process to you.
40		S2		64	Extent to which it was made clear to you whom you should contact during construction.
41		S2		65	Extent to which home builder explained to you warranty coverage.
42		S2		66	Extent to which home builder explained to you your responsibilities for maintenance and upkeep.
43		S2		67	Extent to which home builder explained to you the way the various items in your home operate.
44			S3	71	How satisfied were you with professionalism of home builder personnel?
45			S3	72	How satisfied were you with competence (skills and knowledge) of home builder personnel?
46			S3	73	How satisfied were you with responsiveness (willingness to help and provide prompt service) of home builder personnel?

	Sub-Fac.	Sub-Fac.	Sub-Fac.	Item	SERVICE-continued
47			S3	74	How satisfied were you with reliability (ability to perform the promised service dependably and accurately) of home builder personnel?
48			S3	75	How satisfied were you with courteousness of home builder personnel?
49			S3	76	How satisfied were you with communication with builder's construction personnel?
50			S3	77	How satisfied were you with builder's responsiveness to questions/ concerns?
51			S3	83	How would you rate your satisfaction with your builder's attitude about customer service (i.e. after move-in)?

APPENDIX E
TOTAL QUALITY MANAGEMENT AND HOME-BUYER SATISFACTIO SCORES

Company	F1	F3	F4	F5	F6	F7	F8	TOTALTQM	DESIGN	HOUSE	SERVICE	SATIS	OVERALL
1	3.63	3.2	3.8	3.1	3.97	3.82	3.53	3.58	6.08	4.84	5.04	5.32	5.58
2	3.63	2.74	4.03	3.26	3.9	2.69	3.05	3.33	5.99	4.98	4.4	5.12	5.36
3	3.86	3.66	3.91	3.36	4.17	3.84	3.78	3.8	6.03	5.07	4.74	5.28	5.31
4	3.98	2.7	4.23	3.68	3.87	3.09	3.4	3.56	6.18	5.21	5	5.46	5.47
5	4.17	2.68	4.17	3.76	4.37	2.82	2.75	3.53	5.85	5.56	5.19	5.53	5.58
6	3.69	2.96	3.77	3.22	3.73	3.13	3.2	3.39	6.21	5.27	4.82	5.43	5.22
7	2.97	2.28	3.09	3	3.27	2.36	2.48	2.78	6.42	5.4	4.97	5.6	5.8
8	2.82	1.84	3.63	3.16	3.4	2.42	2.98	2.89	6.14	5.24	4.96	5.45	5.53
9	4.23	3.42	4.06	3.32	3.87	3.6	3.95	3.78	5.72	4.77	4.54	5.01	4.49
10	3.77	2.46	3.6	3.2	3.83	2.56	2.7	3.16	6.13	5.13	4.43	5.23	5.02
11	4.2	2.84	4.2	3.46	3.73	3.47	3.23	3.59	6.11	5.58	5.37	5.69	6.02
12	3.46	2.54	3.23	2.74	3	2.87	2.63	2.92	5.92	5.07	3.97	4.99	4.91
13	3.8	3.18	4.11	3.2	3.9	3.4	3.4	3.57	5.99	4.82	4.51	5.11	5.47
14	3.86	3.7	4.14	4.1	3.83	3.58	3.6	3.83	6.3	5.66	5.39	5.78	5.91
15	4.78	4.28	4.29	3.54	4.3	4.02	4.25	4.21	6.44	5.78	5.54	5.92	5.67
16	3.12	2.28	3.69	2.88	3.67	2.33	2.6	2.94	5.52	5.11	4.59	5.07	5.07
Mean	3.75	2.92	3.87	3.31	3.8	3.13	3.22	3.43	6.06	5.22	4.84	5.37	
Minimum	2.82	1.84	3.09	2.74	3	2.33	2.48	2.78	5.52	4.77	3.97	4.99	4.49
Maximum	4.78	4.28	4.29	4.1	4.37	4.02	4.25	4.21	6.44	5.78	5.54	5.92	6.02
Range	1.96	2.44	1.2	1.36	1.37	1.69	1.77	1.43	0.92	1.01	1.57	0.93	1.53

Total Quality Management and Home-Buyer Satisfaction Scores

LIST OF REFERENCES

Anderson, E.W., Fornell, C., and Lehmann, D. R., "Customer Satisfaction, Market Share, and Profitability: Findings From Sweden," Journal of Marketing, Vol.58, July 1994, pp.53-66.

Austin, N. and Peters, T., A Passion for Excellence, Warner Books, New York, 1985.

Babich, P., "Customer Satisfaction: How good is Enough?" Quality Progress, December 1992, pp.65-67.

Barsky, J., and Labagh, R. "A Strategy for Customer Satisfaction," The Cornell H.R.A. Quarterly, October 1992, pp.32-40.

Becker, S. W., Golomski, W. A. J., and Daniel C. L., "TQM and Organization of the Firm: Theoretical and Empirical Perspectives," Quality Management Journal, Vol. 1, No. 2, 1994, pp.18-24.

Bemowski, K., "Baldridge Award Celebrates Its 10th Birthday With a New Look," Quality Progress, December 1996, pp.49-54.

Berry, W. D., Understanding Regression Assumptions, Sage Publications, Newbury Park, CA, 1993.

Berry, D. W. and Feldman, S., Multiple Regression in Practice, Sage Publications, Inc., Beverly Hills, 1985.

Bohrnstedt, G. W., "Reliability and Validity Assessment in Attitude Measurement," in Dummers, G. F., ed., Attitude Measurement, Rand McNally & Company, Chicago, 1970, pp.80-99.

Brown, J. R. and Fern, E. F., "Goods vs. Service Marketing: A Divergent Perspective," in Donnelly, J. H. and George, W. R., Eds., Marketing of Services, America Marketing Association, Chicago, 1981, pp.205-212.

Builder, "Foreign Builders Set Sail for U.S.," October 1988, pp.84-90.

Builder, "Smooth Selling: What Buyers Want, What Buyers Get," November 1994, pp.84-91.

Builder, "Definitive Details," June 1995a, p.130.

Builder, "Following Up after Move-in," July 1995b, pp.183-190.

Builder, "On the Record: Interview with President Clinton," July 1996, pp.60-64.

Burati, J. L. Jr., Farrington, J. J., and Ledbetter, W. B., "Causes of Quality Deviations in Design and Construction," Journal of Construction Engineering and Management, Vol.118, No.1, March 1992, pp.34-49.

Burati, J. L., Matthews, M. F., and Satyanarayana N. K., "Quality management in Construction Industry," Journal of Construction Engineering and Management, Vol.118, No.1, March 1992, pp.112-128.

Burati, J. L., Michael, F. M., and Satyanarayana, N. K., "Quality management in Construction Industry," Journal of Construction Engineering and Management, Vol.117, No.2, June 1991, pp.341-359.

Business Roundtable (BRT), More Construction for the Money: Summary Report of the Construction Industry's Cost Effectiveness Report, Business Roundtable, New York, 1983.

Buzzell, R. D. and Gale, B. T., The PIMS principles : linking strategy to performance, Free Press, New York; Collier Macmillan, London, 1987.

Carmines, E. G. and Zeller, R. A., Reliability and Validity Assessment, Sage Publications, Beverly Hills, 1979.

Cooper, C., "The House as Symbol of the Self," in Lang, J., Burnette, C., Moleski, W., and Vachon, D., Eds., Designing for Human Behavior, Dowden, Hutchinson & Ross, Inc., Stroudsburg, PA, 1974.

Crosby, P. B., Quality Is Free : The Art of Making Quality Certain, McGraw-Hill, New York, 1979.

Crosby, P. B., Completeness: Quality for The 21st Century, Dutton, New York, 1992.

Damon, D., "Although U.S. Cars Are Improved, Imports Still Win Quality Survey," Wall Street Journal, December 16, 1985, p.29.

Davis, K., and Ledbetter, W. B., "Quality: What Is It and How Do You Get It?" Civil Engineering, Vol.58, July 1988, p.6.

Davis, K., Ledbetter, W. B., and Burati, J. L., "Measuring Design and Construction Quality Costs," Journal of Construction Engineering and Management, Vol.115, No.3, September 1989, pp.385-400.

Deming, W. E., "Report Card on TQM," Management Review, January 1994, pp.22-25.

Dillman, D. A., Mail and Telephone Surveys: The Total Design Method, John Wiley & Sons, New York, 1978.

Dumas, R., "Organizationwide Quality: How to Avoid Common Pitfalls," Quality Progress, May 1989, pp.41-44.

Eccles, R. G., "The Performance Measurement Manifesto," Harvard Business Review, January-February 1991, pp.31-137.

Eccles, R. G. and Pyburn, P. J., "Creating a Comprehensive System to Measure Performance," Management Accounting, October 1992, pp.41-44.

The Economist, "The Cracks in Quality," April 18, 1992, pp.67-68.

Engelkemeyer, S. W., "An Empirical Study of Total Quality Management Practices in U.S. Manufacturing Firms," Ph.D. Dissertation, Clemson University, 1991.

Engineering News Record (ENR), "TQM Is Underutilized, According to Poll," February 1, 1995, p.14.

Engledow, J., "Was Consumer Satisfaction a Pig in a Poke?" Business Horizons, April 1977, pp.87-94.

Fergusson, K. J. and Teicholz, P. M., "Facility Quality Measurement as the Engine of Continuous Product and Process Improvement in the AEC/EPC Industry," Quality Management Journal, Vol.1, No.3, 1994, pp.43-56.

Florida Trend, "Top Rank Florida Residential Home Builders," March 1996, pp.84-85.

Flynn B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A., and Flynn, J. E., "Empirical Research Methods in Operations Management," Journal of Operations Management, Vol.9, No.2, April 1990, pp.250-284.

Fornell, C., "A National Customer Satisfaction Barometer: The Swedish Experience," Journal of Marketing, Vol.55, January 1992, pp.1-21.

Garvin, D. A., "Product Quality: An Important Strategic Weapon," Business Horizons, May-June 1984a, pp.43-47.

Garvin, D. A., "What Does "Product Quality" Really Mean," Sloan Management Review, Fall 1984b, pp.25-43.

Garvin, D. A., Managing Quality : The Strategic and Competitive Edge, Free Press, New York; Collier Macmillan, London, 1988.

General Accounting Office (GAO), "Management Practices: U.S. Companies Improve Performance Through Quality Efforts," United States General Accounting Office, Washington, DC, 1991.

Griffin, A., Gleason, G., Preiss, R., and Shevenagh, D., "Best Practices for Customer Satisfaction in Manufacturing Firms," Sloan Management Review, Winter 1995, pp.87-98.

Gorsuch, R. L., Factor Analysis, 2nd ed., L. Erlbaum Associates, Hillsdale, NJ, 1983.

Gronroos, C., "Strategic Management and Marketing in the Service Sector," Helsingfors: Swedish School of Economics and Business Administration, 1982.

Gutman, R. and Westergaard, B., "Building Evaluation, User Satisfaction, and Design," in Lang, J., Burnette, C., Moleski, W. and Vachon, D., Eds., Designing for Human Behavior, Dowden, Hutchinson & Ross, Inc., Stroudsburg, PA, 1974.

Hartkopf, V.H., Loftness, V. E., and Mill, P. A. D., "The Concept of Total Building Performance and Building Diagnostics," in Davis, G., ed., Building Performance, Function, Preservation and Rehabilitation, ASTM STP901. ASTM, Philadelphia, PA, 1986.

Heady, R. B. and Smith, M., "An Empirical Study of the Topical Differences Between Total Quality Management and Quality Management," Quality Management Journal, Vol.2, No.3, Spring 1995, 24-37.

Heise, D., "Some Methodological Issues in Semantic Differential Research," Psychological Bulletin, Vol.72, No.6, 1969, pp.406-422.

Hempel, D. J., "Consumer Satisfaction With The Home Buying Process: Conceptualization And Measurement," in Hunt, K. H., ed., Conceptualization and Measurement Of Consumer Satisfaction and Dissatisfaction, Marketing Science Institute, Cambridge, MA, 1976.

Hempel, D. J. and Rosenberg, L. J., "Consumer Satisfaction: A Neglected Link?" in Anderson, B. B., ed., Advances in Consumer Research, Vol.III, Proceedings of Association for Consumer Research Sixth Annual Conference, Cincinnati, OH, 1976.

Iacobucci, D., Grayson, K. A., and Ostrom, A. L., "The Calculus of Service Quality and Customer Satisfaction: Theoretical and Empirical Differentiation and Integration," Advances in Services Marketing and Management, Vol.3, 1994, pp.3-67.

Johnson, M. D. and Fornell, C., "A Framework for Comparing Customer Satisfaction Across Individuals and Product Categories," Journal of Economic Psychology, Vol.12, 1991, pp.267-286.

Juran, J. M., "Made in U.S.A.: A Renaissance in Quality," Harvard Business Review, July-August 1993a, pp.42-50.

Juran, J. M., "Why Quality Initiatives Fall," Journal of Business Strategy, Vol.14, No.4, 1993b, pp.35-38.

Kanuk, L. and Conrad, B., "Mail Surveys and Response Rates: A Literature Review," Journal of Marketing Research, Vol.12, November 1975, pp.440-53.

Kaynak, E., "An Analysis of Home Purchase Preferences of Atlantic Canadians," Akron Business and Economic Review, Winter 1985, pp.57-66.

Kelvin, F. C. and Lynch, R. L., "For Good Measure," CMA Magazine, April 1992, pp.20-23.

Kenny, A. A., "A New Paradigm for Quality Assurance," Quality Progress, June 1988, pp.30-32.

Kline, D. H. and Coleman, G. B., "Four Propositions for Quality management of Design Organizations," Journal of Management in Engineering, Vol.8, No.1, January 1992, pp.15-26.

Lackritz, J. R., "TQM Within FORTUNE 500 Corporations," Quality Progress, February 1997, pp.69-72.

Lang, J., Burnette, C., Moleski, W. and Vachon, D., Eds., Designing for Human Behavior. Dowden, Hutchinson & Ross, Inc., Stroudsburg, PA, 1974.

Lehtinen, U. and Lehtinen, J. R., "Service Quality: A Study of Quality Dimensions," unpublished working paper, Service Management Institute, Helsinki, Finland, 1982.

Lewis, F. G., Moving Toward The Future: A Builder's Introduction to Total Quality Management, NAHB Research Center, Inc., Upper Marlboro, MD, 1993.

Lewis-Beck, M. S., Applied Regression: An Introduction, Sage Publications, Inc., Beverly Hills, CA, 1980.

Maloney, W. F., "Framework for Analysis of Performance," Journal of Construction Engineering and Management, Vol.116, No.3, September 1990, pp.399-415.

Matthews, M. F., and Burati, J. L. Jr., Quality Management Organizations and Techniques, Report to CII, The University of Texas at Austin, 1989.

McKim, R. A. and Kiani, H., "Applying Total Quality Management to the North American Construction Industry," Cost Engineering, Vol.37, No.3, March 1995, pp.24-28.

Miller, J. A., "The New Activity Performance Measures," CMA Magazine, April 1992, p.34.

Modern Management Systems, Report A6 of the Business Roundtable's Construction Industry Cost Effectiveness Project, The Business Roundtable, New York, NY, 1983.

Motahari, S., "An Assessment of the Relationship Between Critical Factors of Quality Management and Customer Perceptions of Service Quality," Master's Thesis, Concordia University, Canada, 1993.

National Association of Home Builders (NAHB), Customer Service For Home Builders, Washington, DC, 1988.

National Association of Home Builders (NAHB), Housing: Facts, Figures, and Trends, Washington, DC, 1997.

Natrela, M. G., Experimental Statistics, National Bureau of Standards Handbook 91, United States Department of Commerce, Washington, DC, August 1963.

Newman, G., "The Absolute Measure of Corporate Excellence," Across the Board, October 1991, pp.10-13.

Newsweek, "The Cost of Quality," September 7, 1992.

Nunnally, J. C., Psychometric Theory, 2nd ed., McGraw-Hill, New York, 1978.

Oswald, T. H., and Burati, J. L. Jr., Guidelines for Implementing Total Quality Management in the Engineering and Construction Industry, Report to CII, The University of Texas at Austin, 1992.

Parasuraman, A., Zeithaml, V. A., Berry, L. L. " A Conceptual Model of Service Quality and Its Implications for Future Research," Journal of Marketing, Vol.49, Fall 1985, pp.41-50.

Parasuraman, A., Zeithaml, V. A., Berry, L. L., "SERVQUAL : A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality," Journal of Retailing, Spring 1988, Vol.64, No.1, pp.12-40.

Peters, T. J. and Waterman, R. W. Jr., In Search of Excellence: Lessons From America's Best Run Companies, Harper and Row, New York, 1982.

Peterson, R. A. and Wilson,W. R. "Measuring Customer Satisfaction: Fact and Artifact," Journal of the Academy of Marketing Science, Vol.20, No.1, 1992, pp.61-71.

Preiser, W. F. E., Post Occupancy Evaluation, Van Nostrand Reinhold Co., New York, 1988.

Professional Builder (PB), "The New International Economy: What It Means To U.S. Builders," April 1988, p.24-28.

Professional Builder (PB), "Builder Charged for Emotional Distress," January 1994a, p.16.

Professional Builder (PB), "Quality Failures Consume Up to 60% of Construction Industry Profits," May 1994b, p.42.

Professional Builder (PB), NHQA Supplement, October 1994, p.21.

Professional Builder & Remodeler (PBR), "Poor Sales Tactics?" May 15, 1991, p.9.

Reeves, C. A. and Bednar, D. A., "Defining Quality: Alternatives and Implications," Academy of Management Review, Vol.19, No.3, 1994, pp.419-445.

Rehder, R. and Ralston, F., "Total Quality Management: A Revolutionary Management Philosophy." SAM Advanced Management Journal, Vol.49, No.3, Summer 1984, pp.24-34.

Rust, R. T. and Zahorik, A. J., "Customer Satisfaction, Customer Retention, and Market Share," Journal of Retailing, Vol.69, No.2, Summer 1993, pp.193-215.

Sanvido, V. E., "Conceptual Construction Process Model," Journal of Construction Engineering and Management, Vol.114, No.2, June 1988, pp.294-310.

Saraph, V. J., Benson, P. G., and Schroeder, G. R., "An Instrument for Measuring the Critical Factors of Quality Management," Decision Sciences, Vol.20, No.4, Fall 1989, pp.810-829.

Schwartz M. H., "What Do the Words 'Product' and 'Service' Really Mean for Management?" Quality Progress, June 1992, pp.35-39.

Schoeffler, S., Buzzell, R., and Heany, D., "Impact of Strategic Planning on Profit Performance," Harvard Business Review, March-April 1974, pp.137-145.

Seymour, D. and Low, S. P., "The Quality Debate," Construction Management and Economics, Vol.8, 1990, pp.13-29.

SPSS 7.5, SPSS, Inc., Chicago, 1997.

Swan, J. E. and Combs, L. J., "Product Performance and Consumer Satisfaction: A New Concept," Journal of Marketing, Vol.40, April 1976, pp.25-33.

Tabachnick, B. G. and Fidel, L. S., Using Multivariate Statistics," Harper & Row, Publishers, New York, 1983.

Tucker, R. L., "The Biq 'Q'," The Construction Specifier, May 1990, p.151-152.

U.S. Department of Commerce, C30/97-5, Author, Washington, DC, 1997.

Washington Post, "Builders Brace for Foreign Competitors," November 7, 1987, p.F-1.

Weicher, J. C., "Product Quality and Value in the New Home Market: Implications For Consumer Protection Regulation," Journal of Law and Economics, Vol.24, December 1981, pp.365-398.

Wilkinson, A., Redman, T., and Snape, E., "New Patterns of Quality Management in the United Kingdom," Quality Management Journal, Vol.2, No.2, 1995, pp.37-51.

Winter, M. and Morris, E. W., "The Housing We Would Like," Journal of Home Economics, Vol.69, No.3, May 1977, pp.7-10.

Wiggins, J. H., "Construction's Critical Condition," Civil Engineering, Vol.58, No.10, October 1988, pp.72-73.

Yates, R. E., "Not Level With Competition, Construction Technology in U.S. Lagging," Chicago Tribune, November 9, 1992.

BIOGRAPHICAL SKETCH

Zeljko Torbica was born on May 6, 1962 in Plevlja, Yugoslavia. He enrolled at the Department of Civil Engineering, University of Belgrade in 1981, where he graduated in October 1986.

Zeljko has had 6 years of both office and field experience in design, construction, and bid preparation for a wide variety of projects ranging from residential buildings, 5-star hotels, conference and business centers to industrial complexes. He worked for Energoprojekt, a company which won a worldwide reputation in providing construction, engineering and construction management services in more than 70 countries. For years Energoprojekt has been cited as a leading construction company in ENR's annual ranking of "Top International Contractors." Working for Energoprojekt was a great opportunity for Zeljko to get acquainted with construction practices in Africa, Asia, Europe and South America. His duties included structural design and analysis, scheduling and planning, cost estimating, bidding, and project management.

As a result of his wish to broaden his knowledge, Zeljko continued his studies while working. He enrolled in postgraduate studies in construction management at the University of Belgrade. The program lasted for two years (1986-88). In 1989 Energoprojekt sent Zeljko to London, England, to engage in postgraduate studies in project management and quantity surveying. In London, Zeljko became acquainted with

the British construction practices. In the fall of 1992, Zeljko was admitted to the University of Florida to pursue his Ph.D. His goal in returning to graduate school was to enter an academic career. Zeljko became a doctoral candidate in February 1995 and has since been working on his dissertation.

Zeljko has been recognized and honored with the President's Recognition of Outstanding Students Award, the Award for Outstanding Academic Achievement and Excellence, the Certificate of Recognition for Earning a Cumulative 4.0 GPA, and the M. E. Rinker, Sr., Scholarship.

In 1996 Zeljko was appointed as an assistant professor in the Interior Design and Construction Management Department, at the Mankato State University. Zeljko has just accepted an offer to teach in the Construction Management Department at Florida International University.

Zeljko is a member of the following professional organizations: the Project Management Institute, The American Society for Quality (formerly American Society for Quality Control), the Construction Management Association of America, the American Association of Cost Engineers International, and the Phi Kappa Phi National Honor Society. In addition, Zeljko is a certified Project Management Professional (PMP) and Certified Quality Engineer (CQE).

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert C. Stroh, Chair
Lecturer, Building Construction

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Kwaku Tenah
Associate Professor, Building Construction

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Diane A. Schaub
Assistant Professor, Industrial and System Engineering

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Leon Wetherington
Assistant Professor, Building Construction

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert Cox
Assistant Professor, Building Construction

This dissertation was submitted to the Graduate Faculty of the College of Architecture and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1997

Dean, College of Architecture

Dean, Graduate School